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ABSTRACT

The report examines longitudinal research on language generalization in natural environments of 32 severely retarded, moderately retarded, and mildly language delayed preschool children. All Ss received language training on one of two programs and Ss' speech samples in a natural environment were collected and analyzed for evidence of generalization from training. Reliability measures are detailed. Results of the longitudinal analysis for each S are presented along with graphs of structure generalization, complexity, and rate code data. Specific results of the two programs (that of Guess, Sailor, and Baer with severely speech deficient children and of Stremel and Waryas with mildly deficient Ss) are charted. Among conclusions noted are that language training had a positive effect on language skills of all Ss; across Ss and specific structures, rates of generalized use varied widely with no specific criteria for sufficient generalization. Implications for language training are discussed, such as the importance of focusing on functional language and of a supportive setting. Final sections review ecological descriptive studies, experimental analyses, and environmental intervention studies. (CL)

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VOLUME I

Final Report

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TEACHING LANGUAGE-DEVIANT CHILDREN TO GENERALIZE NEWLY TAUGHT LANGUAGE: A SOCIO-ECOLOGICAL APPROACH

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I. INTRODUCTION

Language is the most complex form of overt human behavior. It necessitates an array of conceptual and physical abilities including a large mnemonic capacity, intermodal association, representational capacity, syntax, imitation, and other skills as minimal conditions. Despite these requirements, by the time normal children enter school they know at least 7,500 words (Nelson, 1973) which they can combine in an infinite number of meaningful statements with astounding linguistic sophistication. As a tool, language guides the child's conceptual and social development as the primary input and output mode of learning and communication.

Given the overriding importance of language development, it is not surprising that it has received increasing attention by those working with the mentally retarded during the last two decades. Attention has been focused on training all aspects of language including vocabulary, syntax, semantics, and pragmatics. During the late 1960's, a large number of studies were conducted to demonstrate that language could be taught to the retarded, especially the severely retarded (e.g., Guess, 1969; Guess & Baer, 1973). By the early 1970's work was underway on developing comprehensive language training programs to train arrays of functional communication skills based on varying theoretical approaches to language development (Bricker & Bricker, 1970; Gray & Ryan, 1973; Guess, Sailor, & Baer, 1978; MacDonald & Blott, 1974; Miller & Yoder, 1974). Fristoe (1976), in a review of language training programs, noted the existence of 176 "language training curricula," although only a score of these were widely used.

The emphasis of most training programs has been comprehensive language development. In fact, most programs teach only specific language skills. Usually, it is assumed that the student possesses or can be taught the basic prelinguistic skills necessary to learn a rudimentary linguistic repertoire. These skills include simple instruction following, generalized imitation, and the ability to form functional response classes, and derive from more basic cognitive abilities such as mnemonic capacity and intermodal association. If a student lacks these prelinguistic skills, they must be trained first.

If the child demonstrates or can be taught the basic prelinguistic skills, language training can proceed. A further assumption is made that the child will be able to generalize from the trained language exemplars to a full repertoire of descriptive language. For training to be successful, the student must utilize recombinate generalization and be able to learn new vocabulary from the natural environment because it is impossible to teach more than a few exemplars of each linguistic response class. Therefore, training programs must select the most salient exemplars, teach them, and assume the student will generalize the underlying rule based on knowledge of the select examples. The

chosen linguistic rules vary somewhat according to the theoretical biases of the program's authors. For example, a semantically-based program (e.g., MacDonald & Blott, 1974) will train exemplars of agent-action-object and other semantic relationships. A more syntactically-based program (e.g., Stremel & Waryas, 1974) might teach various noun-verb-noun constructions, while a function-based program (e.g., Guess, Sailor, & Baer, 1978) might teach certain specific uses of language such as requesting ("want ball") or questioning.

Currently available programs represent various theoretical approaches and incorporate a range of training strategies intended for a variety of populations. Skill levels of children receiving language training range from mildly delayed preschool children capable of normal development with extra stimulation to severely retarded adolescents for whom the training goal is a functional but restricted productive repertoire. Trainers include certified speech therapists, classroom teachers, staff aides in residential treatment facilities, and parents.

Most available programs are tailored to specific language delayed populations. Some are designed to teach a specific set of skills applicable for the severely retarded; others train general language skills as part of a broader academic curriculum. Programs vary according to their relative emphasis on stimulation or remediation, use of operant or non-operant procedures, degree of structure, recommended format (i.e., one-to-one, group), required criterion levels, prerequisite skills, grammatical content, skills needed by trainer, assessment strategies, and emphasis on data collection.

Two clearly identifiable theoretical models are represented in language training programs: a function-based model closely related to the operant training experiments, and a developmental model influenced by psycholinguistic studies of normal language acquisition. Across theoretical orientations, a surprising number of similarities exist. All programs maintain that language can be taught. Most curricula begin with rudimentary verbal and nonverbal skills and progress to more sophisticated verbal skills. All use operant procedures to some extent and all rely on regular assessment of student performance and on data collection within the training setting. A number of quite similar surface structures (grammatical examples) are taught across programs in spite of their different theoretical orientations.

Language Generalization

Although language training programs are now widely used, very little is known about their actual therapeutic effectiveness. Generalization is critical for successful language remediation. The purpose of language training is to provide a generative communication repertoire which the language delayed individual can display across persons, settings, objects, and events. Yet, if evidence from other types of behavior-change

programs (Stokes & Baer, 1977) is representative, it seems unlikely that language training produces sufficient generalization to meet the goal of training communicative competence. Thus, as in many other treatment areas, one focus of research and development efforts in language remediation is ways to enhance and facilitate generalization.

Defining and measuring generalization from language training is a complex task. The common definitions of stimulus generalization (generalization across persons, settings, objects, or time) and response generalization (the display of responses functionally similar to those trained as potential members of the same response class) provide only a limited beginning. Generalized language may represent either stimulus or response generalization, or a combination of both. Stimulus generalizations may be easy or difficult depending on the characteristics of the setting in which the generalized response occurs. Generalization across stimuli may occur relatively easily when the stimuli closely resemble those present during training (for example, the correct use of the label "ball" in the classroom setting when the teacher holds up a ball similar to one used in training and says, "What is this?"). The same response in a less similar circumstance should be more difficult (e.g., if the trained child had said "ball" while looking at a picture of a ball, with no accompanying verbal prompt from an adult). Similarly, response generalization may be the simple recombination of two trained forms to produce a novel utterance (trained noun + trained verb) or the more complex generalization of a novel sentence incorporating no previously trained forms but conforming to the implicity trained grammatical structure (novel noun + novel verb + novel noun). The successful use of language as a communication tool requires both stimulus and response generalization, usually concurrently. The language-learning child will need to produce semi-novel utterances (incorporating trained and novel forms into trained grammatical forms) describing new events and objects in a variety of settings. To use language in the creative, flexible manner required in communication contexts, training must generalize across stimuli and responses. No language-training program, regardless of how carefully it is structured or administered, can possibly train every potentially needed utterance or extend training to all possible events, persons, and settings. The student must be able to recombine trained and untrained forms to appropriately communicate new needs.

Most studies purporting to measure language generalization have relied on structured probes for their analysis (cf. Guess & Baer, 1973; Guess, Sailor, Rutherford, & Baer, 1968; Schumaker & Sherman, 1970). Typically, probe trials have been interspersed among training trials or administered at the completion of training. Correct responses on probe trials usually are not reinforced. Using a fixed number of trials and stimuli that vary systematically from those used in training, it is possible to accurately assess the generalization of a specific skill. Probes can be quite useful in determining the extent to which a certain rule has generalized, but they may have limited applicability in assessing

the extent to which language training results in the natural use of language as a communication tool.

The research on language generalization utilizing structured probe assessments has made a significant contribution to current knowledge of generalization as a process as well as to the development of systematic language-training programs (Guess, Keogh, & Sailor, 1978; Harris, 1975). The majority of studies examined some aspect of morphological development or syntactic development; a few examined conversational speech. For example, Guess and Baer (1973) trained severely retarded subjects in the receptive and productive use of the plural morphemes "s" and "es." They measured generalization through interspersed probes of subjects' productive and receptive labeling using the trained morphemes. Lutzker and Sherman (1974) trained three retarded subjects and two developmentally normal toddlers to use sentences with correct subject-verb agreement to describe pictures. Generalization was assessed on the basis of the subjects' sentence descriptions of novel pictures presented in interspersed probe trials. Other examples of generalization analyses of morphological training include Baer and Guess (1971, 1973), Guess (1969), Guess, Sailor, Rutherford, and Baer (1968), Sailor (1971), and Schumaker and Sherman (1970). Examples of generalization analyses of syntactic training include Bennett and Ling (1972), Clark and Sherman (1975), Garcia, Guess, and Byrnes (1973), Hester and Hendrickson (1977), Jeffree, Wheldall, and Mittler (1973), Stevens-Long and Rasmussen (1974), and Wheeler and Sulzer (1970). Examples of generalization analyses of conversational speech can be found in Garcia (1974), and Keilitz, Tucker, and Horner (1973).

The generalization analyses conducted in these studies generally present positive results. It appears that it is relatively easy to establish generalized responding within a morphological or syntactic response class under controlled conditions (Guess, Keogh, & Sailor, 1978; Harris, 1975). However, these results may not accurately represent what occurs in comprehensive language-training programs. The studies summarized taught a range of language skills from the use of one specific grammatical form to the chaining together of two or three specific conversational statements. However, no study taught more than two or three components of the language system. Thus, these investigations are much more limited in content and purpose than common language-training programs that propose to teach functional language. Although these studies are experimentally sound and provide important information, extensive assessments of generalization in natural environments are needed to provide accurate information about generalization of training resulting from language-training programs.

Reports of language generalization in the natural environment have been very limited to date (e.g., Hester & Hendrickson, 1977; Jeffree, Wheldall, & Mittler, 1973). The limited naturalistic research is due, at least in part, to the nature of the behavior being studied. Many words and sentence forms are situation specific. They are only

appropriate under certain circumstances. It is more economical to create relevant circumstances via probes than to await occasions for their natural occurrence. Because the natural environment is more subtle than the experimenters probes, estimates of generalization from probes may not accurately reflect the child's communicative behavior.

Naturalistic assessment is complicated by the student's possible acquisition of some trained words and sentence forms from the natural environment, rather than from the intervention program. For example, statements incorporating "want" ("I want cookie") are frequently taught in language training and modeled, prompted, and reinforced in classroom and home routines. When a child acquires generalized use of this form, it is difficult to attribute acquisition to either form or incidental training alone. This is not important clinically, but it is a problem in accurate documentation of generalization from training. What might appear to be a generalized effect may be the result of learning that occurs in the natural environment. Children are always exposed to language in the natural environment, and some acquisition occurs even with severely retarded students.

Natural environment generalization analyses that might counter these methodological problems require a more sophisticated and expensive method than the structured probe research. Nevertheless, these analyses are ultimately necessary to evaluate the actual effectiveness of language training programs.

Overview

The research reported here was funded by the Bureau for the Education of the Handicapped to (1) measure generalization from language training to nontraining environments, (2) conduct an ecological analysis of living environments to identify variables and conditions that set the occasion for language use, (3) to conduct experimental analyses of generalization in controlled settings, and to (4) develop procedures and techniques that can be used to enhance generalization when it does not occur. Each objective is outlined briefly below.

1. To measure generalization from structured language training environments. This objective was aimed at determining the extent to which trained language skills generalize to a child's natural environment, including the classroom home, and other living settings. Longitudinal verbatim observations were conducted with children at four research sites. Because subjects studied at the Big Lakes Child Development Center (Kansas State site) failed to acquire speech beyond the one word stage, the longitudinal data are reported only for the Language Project Preschool, Kansas Neurological Institute, and Parsons State Hospital settings. Results from subjects ranging from severely retarded institutionalized adolescents to language delayed

preschool children are reported. Important implications for training curricula and future research are presented. The methodology, results, and discussion of the longitudinal research are in Section II of this report.

2. Conduct an ecological analysis of living environments to identify variables and conditions that set the occasion for speech to occur. This objective provided an analysis of conditions and variables that effect language use in the natural environment, and identified parameters of the environment that increase verbal expression. Eleven studies were completed on this topic. These findings and their implications are reported in Section III.

3. To conduct experimental analyses of generalization in controlled settings. The purpose of this objective was to conduct specific experiments under controlled conditions on variables that appear to effect the establishment of generalized language. Six separate analyses were conducted in the course of the grant. They are summarized and discussed in Section IV.

4. To develop procedures and techniques that can be used to enhance generalization when it does not occur. This objective was aimed at developing procedures for establishing and maintaining generalization in the natural environment. A total of nine different studies were conducted. Their results and implications are reported in Section V.

The four research dimensions are closely related and taken together represent a comprehensive analysis of the problem of language generalization. Thus, in Section VI the findings are integrated into a general overview. The implications for language remediation efforts are presented and suggestions for future research and program development are made. Also included in the report is a summary of dissemination activities and product development (see Volume II). For organizational purposes, all eight appendices referred to within the report can be found in the accompanying Volume II (which is solely composed of these appendices).

A separate financial report has been prepared by the Office of Research Administration at the University of Kansas and is not included with this report. It will be sent under a separate cover to the appropriate budgets and contracts officials. The equipment purchased with grant funds, eight FM telemetry recording systems, will be used to conduct the research mandated in the grant recently awarded by the Bureau of Education for the Handicapped (OEO-G007905112) to R. L. Schiefelbusch. This program of research relates directly to the findings discussed here and involves a similar research methodology for which this equipment is necessary.

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This research program was a joint effort of several institutions including the Big Lakes Child Development Center, Manhattan, Kansas; Kansas State University; the Parsons State Hospital and Training Center; and the Kansas Neurological Institute. All of these organizations cooperated fully with the Bureau of Child Research at the University of Kansas in the conduct of this research program.

II. LONGITUDINAL GENERALIZATION ANALYSES

Introduction

The longitudinal analysis of language generalization in natural environments was a primary research objective. The analysis was successfully completed with three of the four research populations; severely retarded institutionalized children, moderately retarded institutionalized children, and language delayed preschool children. The analysis was attempted with the fourth population, preschool Down's Syndrome children. However, the unexpectedly slow pace at which these children progressed through training on the necessary prerequisites for productive language training stymied this analysis. Future analysis with Down's Syndrome children should be conducted with older, more advanced populations.

The longitudinal generalization analysis was completed for 32 subjects; eight at the Parsons site, 13 at the Lawrence site, and 11 at the Kansas Neurological Institute site. The same methodology was implemented at all sites. Methods used are presented in one section although the results obtained are presented individually by site. Because a standard methodology was used the findings and implications of this research are discussed together.

Methods

Subjects and Settings

Kansas Neurological Institute. Kansas Neurological Institute (KNI) is a state residential facility for severely and profoundly retarded children. The majority of KNI residents are school-aged. Longitudinal generalization analyses were conducted for 11 children at KNI. All received systematic daily language training on the Guess, Sailor, and Baer language training program or Stremel and Waryas program. All subjects were severely retarded but capable of productive vocal speech. Specific characteristics of each subject are presented in Table 1 below.

Insert Table 1 about here

Subjects were observed in four different settings within the institution: the classroom, dining hall, living unit, and art classroom. These settings are each described below.

Classroom. All subjects attended the same classroom in the institution. The class operated six hours each day, five days per week, approximately 11 months of the year. It was staffed by one certified special education

TABLE 1

KNI SUBJECT CHARACTERISTICS

SUBJECT	SEX	AGE AT START	LENGTH OF OBSERVATION	HOUSTON LANGUAGE AGE	PEABODY PICTURE VOCABULARY TEST
DX	male	14.2	31 mo.	24 mo.	2-7
SC	male	12.1	30 mo.	32 mo.	2-3
JM	male	12.7	16 mo.	20 mo.	1-11
TG	female	8.1	20 mo.	35 mo.	3-2
SI	female	20.8	19 mo.	31 mo.	2-3
BT	male	12.8	17 mo.	35 mo.	3-0
CL	male	15.1	20 mo.	31 mo.	2-1
BH	male	11.5	13 mo.	20 mo.	-1-9
KM	male	19.2	11 mo.	36 mo.	4-8
KO	male	8.2	4 mo.	28 mo.	2-3
WW	male	11.9	7 mo.	not avail.	not avail.

teacher and three college-educated assistants. The class consisted of 16 severely retarded children. Individual academic programs and one-to-one language training were provided for each child. Four children usually worked with each staff member during the majority of the day, although there were some large group activities (show and tell, group singing, etc.).

Art Classroom. The art classroom was a special facility which each subject attended for 30 minutes, four days each week. A maximum of six children worked with a single art teacher at any given time. Typical activities included pegboards, puzzles, Lego buiding, painting and coloring and occasionally required some limited cooperation and communication between children to complete.

Dining Hall. Subjects ate in a large communal dining hall where meals were served cafeteria style. Six residents were seated at each table with one teacher or staff member. The typical dining period lasted about 30 minutes. After completing their own meals, children waited for their peers and teachers to finish before returning to the classroom.

Living Unit. The children spent late afternoons, evenings, and early mornings in their living units. Sixteen children were assigned to each unit. The physical facilities of the unit consisted of four bedrooms, a large dayroom where some toys were available, a TV room, and a large bathroom. Typically, two staff members were present to supervise the children. Most of the childrens' time on the unit was unstructured and little child-adult to peer interaction occurred in this setting.

Language Project Preschool. The Language Project Preschool (LPP) is a facility of the Bureau of Child Research of the University of Kansas located in Lawrence, Kansas. The preschool annually serves 10 children with mild and moderate (6 month to 2 years below age level) language delays. The children participate in a regular half-day preschool curriculum, and receive daily language training during 20-minute sessions with a speech clinician. Language training is based on the Stremel and Waryas program (described in Appendix 1). Children usually are enrolled for one to two years. Longitudinal generalization analyses were conducted on 13 children at LPP. The specific characteristics of these children are presented in Table 2 below.

Insert Table 2 about here

Subjects were observed an average of four times each week while participating in a freeplay period at LPP. During this time, children were free to participate in games or group activities provided by a teacher but they were not required to do anything. Typically, a high rate of interactions occurred during this time, but interactions were not specifically structured. Observations were also conducted in another classroom and/or in children's home. Observations taken in other classrooms

TABLE 2

LPP SUBJECT CHARACTERISTICS

SUBJECT	SEX	AGE AT START	LENGTH OF OBSERVATION	HOUSTON LANGUAGE AGE	PEABODY PICTURE VOCABULARY TEST
DA	male	2.8	20 mo.	26 mo.	1-10
DN	male	4.0	20 mo.	3 yr +	2-10
MJ	male	3.0	21 mo	3 yrs	2-5
JC	male	2.5	21 mo.	3 yrs	2-3
DK	female	3.11	3 mo.	-3 yrs	2-2
JW	male	4.0	9 mo.	4 yr +	3-10
LC	female	3.0	14 mo.	24 mo.	2-11
WA	male	3.1	16 mo.	4 yrs	3-1
CZ	male	4.5	9 mo.	-3 yrs	2-6
CU	male	2.11	9 mo.	21 mo.	4-7
JI	female	3.3	11 mo.	31 mo.	2-3
KS	male	3.1	11 mo.	31 mo.	2-3
SQ	female	3.7	4 mo.	not avail.	not avail.

occurred during a freeplay period similar to the observation period at LPP. Home observations were conducted when the child and a parent were present in the same room, but the situation otherwise was unstructured.

Parsons State Hospital. Parsons State Hospital is a state residential institution for severely retarded children. The majority of Parsons residents are school aged. Longitudinal generalization analyses were conducted on 8 children. All received systematic language training on the Stremel and Waryas (1974) language training program. Generally, the children studied in this setting were higher level than those studied at KNI. They had more complex language, better overall communication skills, and most were considered prime candidates for community placement. However, four of the eight children were nonverbal and communicated (and were trained) with manual signs. Specific characteristics of each subject are presented in Table 3 below.

Insert Table 3 about here

Most subjects were observed four times per week in each of three settings: their academic classroom, a freeplay period within the classroom, and when possible, in the dining hall. These settings are described below.

Academic Classroom. All subjects attended a full-day special education classroom in the institution. It was staffed by a certified special education teacher and three college-educated assistants. The class consisted of 14 moderately and severely retarded children. Individual academic programs and small group language training were provided for each child. Small groups of children generally worked with an adult during the academic periods when observations were taken.

Freeplay. A freeplay period was included in the school day for all subjects. Although the children remained in the classroom, during this period they were free to participate in a range of group and individual play activities. Teachers were present and interacted with the subjects during this time, but the subjects were not required to participate in or complete specific activities.

Dining Hall. A limited number of observations were taken in this setting, a large communal dining facility in which the subjects were served meals cafeteria style. Six residents were usually seated at each table with a teacher or staff member. The period typically lasted 30 minutes. After completing their own meal, children waited for their peers and teachers to finish before returning to the academic setting.

Language Training. Each subject received systematic language training in either the Guess, Sailor, and Baer language training program or the Stremel and Waryas language training program. Following program-

Table 3

Parsons' Subject Characteristics

Subject	Sex	Age at Start	Length of Observation	Houston Language Age	Peabody Picture Vocabulary Test	Communication Modality
C.W.	M	10.9	24 mo.	23 mo.	2.5 M.A.	Vocal
M.G.	M	14.4	19 mo.	20 mo.	1.11 M.A.	Sign
K.M.	M	14.6	18 mo.	20.2 mo.	2.5 M.A.	Sign
W.P.	F	15.7	10 mo.	25.6 mo.	3.8 M.A.	Sign
C.R.	M	12.2	10 mo.	24 mo.	2.10 M.A.	Vocal
J.R.	M	14.0	8 mo.	----	2.6 M.A.	Sign
T.B.	M	11.0	7 mo.	34 mo.	3.5 M.A.	Vocal
R.B.	M	9.7	9 mo.	33 mo.	4.11 M.A.	Vocal

specific assessment, a child began in either the Guess, Sailor, and Baer or the Stremel and Waryas training program. The child was placed at the specific step of the program that most closely resembled his/her language abilities.

Once training commenced, the child met daily with the language trainer for 15-20 minutes. In the Guess, Sailor, and Baer program, training was done in a one-to-one session; in the Stremel and Waryas program training was carried out either one-to-one or in a small group of children receiving similar training. Both programs relied on modeling, imitation, and differential reinforcement to teach the content of each step. Children move through both programs by reaching criterion on each step. Slightly different criteria are defined by each program, but the essential requirement was that the child demonstrate at least 80-90% success on a series of trials over a given training item during two consecutive sessions. As the child progressed through the training steps in each program, reliability was assessed to determine if the trainer was following the training procedures appropriately, and to determine if the child's performance in training was being recorded correctly by the trainer.

The Stremel and Waryas and the Guess, Sailor, and Baer programs were used because they are representative of language teaching technology and incorporate procedures for promoting generalization. The programs are somewhat contrastive models of intervention curricula. The Guess, Sailor, and Baer program is based entirely on functional language and is ordered from simple to complex, rather than following a developmental sequence. The Stremel and Waryas program has been developed on the basis of psycholinguistic theory and research. The program teaches syntax and semantics in the order they typically emerge in normally developing children. Differences in theoretical bases and target populations results in differences in content; however, there is some overlap among structures trained at the earliest levels of the two programs. In general, the two programs are representative of content and procedures of other available programs, and were particularly applicable for the populations studied.

The two programs contain some training procedures that may promote generalization. For example, the Guess, Sailor, and Baer program employs two trainers and multiple exemplars of stimuli as a part of training--two techniques that have been shown (Stokes & Baer, 1977) to facilitate generalization. The Stremel and Waryas program emphasizes the use of stimuli common in the child's normal environments, and suggests training children in small groups to encourage conversational use of trained forms. Inclusion of these techniques in the training should increase the probability of generalization.

The Guess, Sailor, and Baer program and the Stremel and Waryas program are described below in terms of their respective purposes,

theoretical bases, general content, procedures, and limitations. An extensive technical description of each can be found in Appendix 1.

The Guess, Sailor, and Baer Program. The Guess, Sailor, and Baer program (1974, 1978) is designed to improve the language of severely deficient persons, particularly the institutionalized profoundly retarded. The only prerequisites for program entry are basic imitation skills. The program is behaviorally oriented.

Program content is organized around teaching four functions: reference, control, self-extended control, and integration. Reference is the appropriate use of labels to represent things and actions. Control is the use of requests (I want milk) and affirmation and negation (yes and no). Self-extended control is the gaining of useful information from the environment, primarily by question asking (e.g., "What is that?"). Integration is the combining of reference, control, and self-extended control in meaningful ways. Gues, Sailor, and Baer assume that successful instruction of these four program elements will produce the fundamental characteristics of language. Emphasis is placed on productive language, and there is relatively less attention to receptive training than in most language programs.

The Guess, Sailor, and Baer program is designed to be taught in one-to-one training situations using operant procedures. The first step of the program involves teaching the child to use 16 labels productively. The labels are selected by the trainers from the objects frequently encountered by the child being trained. The program proceeds through 66 well-specified steps. The published version of the program is the result of extensive field testing in several states. Unlike many training programs, trainers are required to keep extensive behavioral data. Independent reliability is to be taken on the child's performance on each step of the program before the child is advanced to the next higher step.

The Guess, Sailor, and Baer program is well-specified and systematic but attends less to the development of the conceptual underpinnings of language explicit in the semantic orientations of many other programs. The language forms trained were selected to be the most functional for the minimally skilled child in a limited environment (who probably would then go on to some form of classroom instruction). The terminal goal is not to produce an adult-like grammatical system, but a limited set of functional utterances that will control some of the child's present environment. The program includes procedures for programming generalization and its thoroughness makes it ideal for paraprofessional use.

The Stremel and Waryas Program. Stremel (1972) and Stremel and Waryas (1978) have developed an intervention program for higher-level populations than the Guess, Sailor, and Baer program. In order to enter the first step, a child should be able to attend to the supervising

adult, follow simple instructions, and comprehend and label at least 10 pictures and objects.

The program is based on the tenet that early language acquisition is best described as a rule-governed system that progresses in sequential stages. Following the guidelines offered by Bloom (1971, 1974) and others, Stremel and Waryas stress the teaching of grammatical forms (e.g., subject-verb-object) to express underlying semantic relations. Like the Guess, Sailor, and Baer program, individual responses within each step of the Stremel and Waryas program are taught by applying operant conditioning techniques (stimulus control, shaping, and differential reinforcement). The program is thus a combination of psycholinguistic theory and operant technology.

The curriculum has three content areas: (I) Early Language Training; (II) Early-Intermediate Language Training; and (III) Late-Intermediate Language Training. The Early-Language Training phase teaches the child to express a wide range of nouns and verbs; then, language structures such as NOUN + VERB ("Mama go") and VERB + NOUN ("want cookie"). As training progresses, these grammatical structures are expanded to include pronouns, adjectives, prepositions, and the who-what-where questions. Training emphasizes both receptive and productive use of these basic grammatical structures. After students have mastered most of the grammatical structures trained in Phase I, they are advanced to Early-Intermediate Training. During this phase, group instruction may replace one-to-one instruction. Training in this phase focuses on expanding the use of a basic grammatical repertoire and teaches the productive and receptive use of auxiliary verbs, negatives, and possessives. The final phase continues to build grammar and use of syntax by teaching plurals and noun/verb tense agreement along with other forms.

The Stremel and Waryas program is not as well specified as the Guess, Sailor, and Baer program, nor is it available as a completely published training program at this time. In order to use it appropriately, it is necessary currently to get at least some training from the developers. The program is widely used, although it has not been field-tested outside of the Parsons State Hospital where it was developed.

Verbatim Observations. Data for the longitudinal analyses of subjects' language generalization to the natural environment was derived from samples of subjects' language in the natural environment. A trained observer made verbatim transcriptions of subjects' utterances during 15-min observation periods. During the observation a tape-recording of the child's language and the language directed to the child was made. The observer used the tape-recorded sample to supplement and correct the record made in vivo. Tape recordings of the children's language were obtained by having subjects wear an apron containing a small, wireless microphone. Their speech was transmitted to a receiver and a tape recorder located in an adjacent room. Procedures for verbatim observations and preparation of language samples are included in Appendix 2.

Following collection, data were entered into a computer and analyzed using a computer program described later in this report. From this computer analysis further analyses were conducted by data clerks and the data was summarized and graphed.

The system used to determine reliability and the reliability quotients obtained are presented later in this report.

A flow chart of the verbatim data collection and analysis system is shown below in Figure 1.

Insert Figure 1 about here

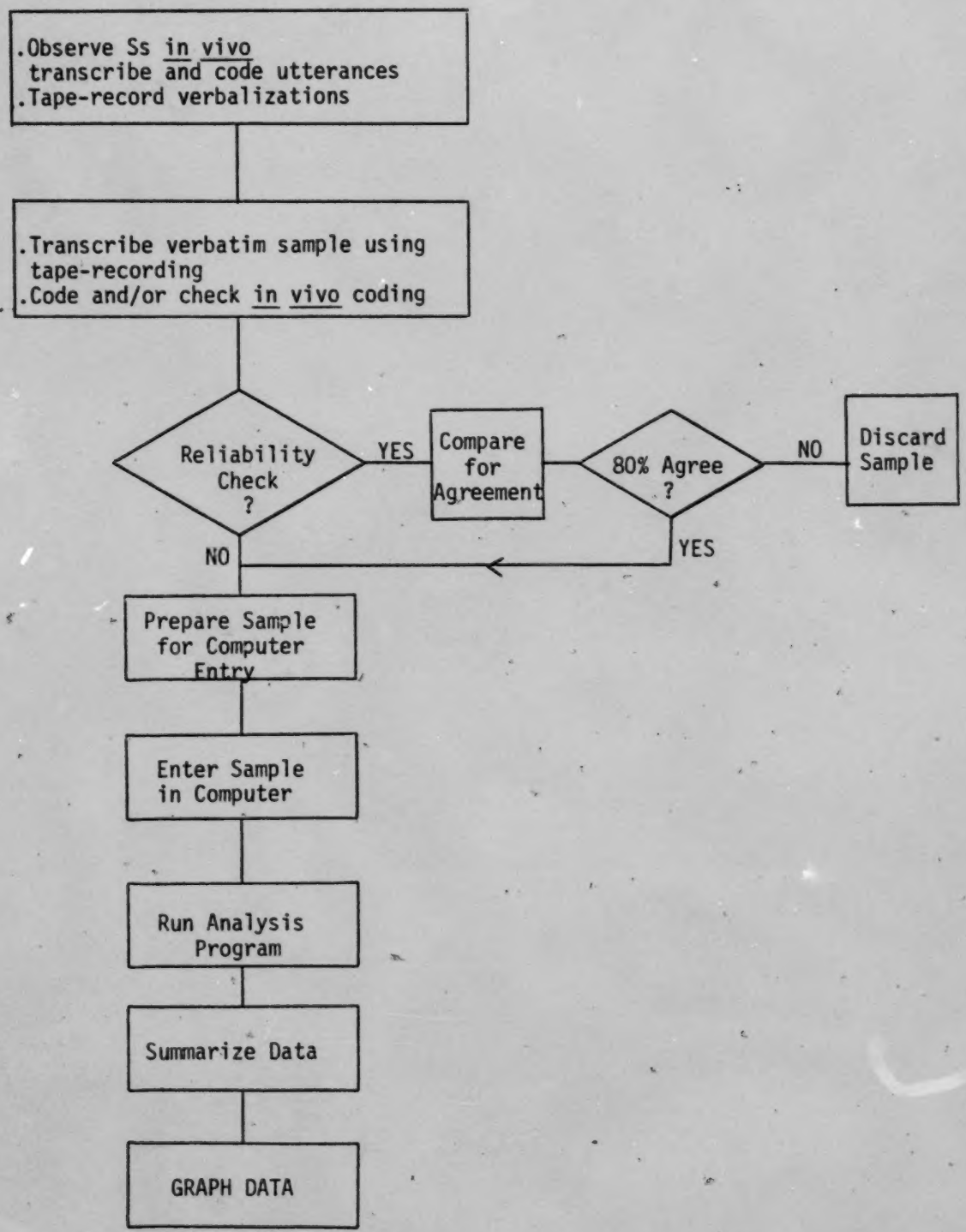
Rate Code Observations. Measures of the rates of the subjects' language, and of adult and peer language directed to the subjects, were taken using a complex observational code. (A copy of this code is in Appendix 2). Adults and peers were observed for their questions, mands for verbalization, models for verbalizations, commentary, and praise for verbalizations directed toward the subject being observed. Subjects' initiations and responses to adult and peer verbalizations were recorded. Data were recorded sequentially so that functional relationships between adult/peer verbalizations and subject verbalizations could be determined. These data were used to compile quantitative descriptions of the demand and support for verbalizations provided in an environment. Observations were conducted in all settings where verbatim records were made. However, rate observations were not made for all subjects nor were they taken at all times during the three-year research period. The data for each subject are presented in combination with the longitudinal generalization data in the results section. Reliability data on the observation code can be found in the reliability results section.

Data Analysis. The generalized effects of language training on several dimensions of the subjects' communication behavior were examined. Three dimensions were studied with the assistance of a computer system. These included vocabulary generalization, structure generalization, and changes in the complexity of the subject's speech during the treatment period. Changes in rates of subjects' language display, responsiveness to verbal input, and performance on standardized tests were also examined. The computer-based analysis system and other generalization measures are described below.

1. Computer Analysis. The computer-based analysis system compared what the child said in the natural environment with trained forms and counted examples of generalization from training. Two types of data were entered into the computer: (1) the specific words (vocabulary) and linguistic structures (e.g., noun-verb; noun-verb-

Figure 1

Data Collection Procedures



noun; etc.) trained; (2) verbatim samples of the child's language in the natural environment. The program was designed to:

a. Assign part-of-speech categories to all words;
b. Keep track of all the words found in a child's language samples;
c. Keep track of all the examples of trained phrases found in the samples;
d. Keep track of all the words and sentence patterns used in language training for the child;
e. Find all the trained words and sentence patterns that occur in the language samples (generalization to the natural setting);
f. Print a summary of all these findings in five different tables.

The computer system to accomplish these tasks was made up of several separate programs that were run at various stages in the language analysis process. Appendix 3 contains diagrams that describe how the various programs fit together and a brief description of each program.

The program assessed word and structure generalization directly as well as measuring changes in overall complexity of child speech. It provided an extremely efficient storage system for the mass of verbatim and training data collected on each subject.

2. Word Generalization. For some of the children studied, language training began with training on labels for common objects (e.g., milk, ball, hat). Both the Guess, Sailor, and Baer and the Stremel and Waryas programs train sets of single words to criterion before beginning training on word combinations. The computer program analyzed word generalization by comparing each child's list of trained labels with the spontaneous (non-imitated) words in the child's verbatim samples. Each occurrence of a trained word was counted and a dictionary of the child's entire vocabulary was compiled. Word generalization data are presented in the results section for each child who received noun label training.

3. Structure Generalization. In addition to acquiring labels to refer to things and actions, the language-learning child must learn a set of rules for combining words into sentences. These rules are trained by teaching multiple exemplars of each. The child's task is to learn the rule for ordering words into similar sentences from these examples, and to demonstrate knowledge of the rule by producing novel, correctly ordered sentences.

Evidence of generalization from training could take three forms: (1) the child could use the exact sentence taught in training (e.g., "I want a cookie"); (2) the child could use the structure trained (e.g., pronoun-state verb-article-noun) and substitute different examples for some of the parts of speech (e.g., "I want a truck"); or (3) the child could use the structure trained and substitute untrained forms for all the parts of speech ("She needs the pencil").

The conceptualization of generalization must take into account the purpose of the language training. For example, the purpose of the Guess, Sailor, and Baer program is to train a basic communicative repertoire, but does not train a complete generative language system. Because the program has limited objectives, it should be used primarily with severely or profoundly retarded individuals who have limited potential for language use. Generalization should be analyzed in terms of the specific goal of the program. The goals of the first half of the program (30 steps) are to teach students control and question-asking functions, a basic set of referents, and appropriate "yes/no" discrimination skills. Structurally, four forms are trained. These forms, examples of the forms, and steps training these forms are shown in Table 4 below. Structural generalization

---

Insert Table 4 about here

---

for all subjects trained on the Guess, Sailor, and Baer program was analyzed across these four forms.

The Stremel and Waryas program was designed for higher level children. It teaches both general and specific syntactic rules that form the bases of a complete language repertoire by training exemplars of these rules. For example, the general structure Pronoun-State Verb-Article-Noun is taught by training the student to produce a series of examples such as "I want a cookie," under the appropriate stimulus conditions. Specific forms are combined into more general forms. For example, the general form (Modifier) Nominal-Verb (Modifier) Nominal could be taught using the examples from component structures, Noun-Verb-Noun, Pronoun-State Verb-Noun and Noun-Verb-Adjective-Noun. In the structural generalization results sections, data are presented for these general forms with the specific forms represented as training exemplars of these structures.

Regardless of the training program used, generalization data were collected in the same way and initially analyzed using the same computer program. A record of each subject's training, including syntactic patterns and examples, was compared with the transcript of utterances for each sample. The computer coded each utterance in the transcribed sample as a syntactic string (e.g., Noun-Verb-Noun; Pronoun-Verb; Pronoun-Verb-Adjective-Noun), then compared each utterance pattern with the patterns trained or to be trained. Two summaries of generalization of structures, first occurrence (novel examples of a trained pattern) and frequency (total number of instances) of usage of the trained pattern

Table 4

Structure Generalization Forms

Guess, Sailor, and Baer Program

Steps 1-29

Form	Exemplars	Steps
I want (+)	Want (N) I want (N) I want (verb) I want (verb) (object) I want you (verb) I want you (verb) (object)	3, 8, 9, 10A, 11A, 15A, 16, 18, 20, 22, 24, 29 = 12
What (that)? (doing)?	What that? What doing? What (are) you doing?	4, 5, 6, 25, 27A, 28A = 6
I/You (verb) (ing)	I (verb) You (verb) (ing)	10B, 13, 16 = 3 (11, 14, 15, 18, 20, 22, 24, 27, 28, 29)
I/You (verb) (object)	I (verb) (object) You (verb) (ing) (object) I/You (verb) (ing) (object) You (verb) (object)	11, 14, 15, 18, 20, 22, 24, 27, 28, 29 = 10

were computed for each verbatim sample. The computer analysis system is outlined in Table 5 below.

Insert Table 5 about here

An experimental analysis of structure generalization is possible when language training proceeds through a series of steps in each of which a specific structure is taught. By taking baseline measures on a subject's use of structure prior to training, a multiple baseline experimental analysis (Baer, Wolf, & Risley, 1968) is possible in which each syntax trained represents a separate baseline. A sufficient experimental analysis and generalization assessment requires that at least three forms be trained and measured sequentially and that the subjects' spontaneous language be monitored for a length of time before and after training to demonstrate experimental control. Where possible, experimental designs were implemented and are represented in the individual subject data presented in the results section.

4. Complexity Measures. The complexity of a child's speech can be estimated in several ways. Complexity measures represent general features of a child's speech, for example, the typical length of utterances, or the frequency of nouns, verbs, and modifiers. Complexity measures are useful in tracking major developmental changes in the child's speech, but do not describe specific acquisition or generalization. These measures were used to represent increases and changes in subjects' overall development, and may be indirect measures of the effects of language training. Eight measures were calculated for subjects. They were made directly from the verbatim records or each subject and done by the computer program previously described. These measures are briefly described below.

Mean Length of Utterance (MLU). MLU is a widely used measure of a child's general language competency. An MLU of 1.0 indicates a child is only using one-word utterances. A higher MLU would indicate the child combines words to make sentences, at least sometimes. MLU is a useful indication of structural complexity until the child reaches an MLU of about 1.4 or 4.0.

Upperbound. Upperbound refers to the longest meaningful sentence found in a given verbatim sample. It is a numerical representation to some extent, of the most complex linguistic example in a given sample. For example, the first time a child displayed a 5-word sentence in a sample, it would then be noted by this measure. Across observations, upperbound indicates the child's progress in terms of length of utterances. Upperbound is a range indicator; MLU is a modal or typical performance measure.

Table 5

SYNTAX ANALYSIS PROGRAM

PROCEDURE	EXPLANATION
1. Read each utterance	Utterances in sample are read sequentially
2. Segment main clause(s)	Removes vocatives (names and attentional words) and interactionals (e.g., please)
3. Assign syntax notation	Each word was previously assigned a part of speech in the word analysis stage. Parts of speech are recalled from the sentence record and printed in sequence to produce a syntactic string
4. Compare syntactic pattern of utterance with training patterns	Program searches the list of trained syntax forms and indicates if the utterance matches a training form
5. Determine if form is novel	Program compares current utterance with all previous examples of the same syntactic form and indicates if the utterance is an old or new example of that form
6. Enter example into subject's clause dictionary	If the example is novel, it is entered into the list of examples of the form used by the subject. Tallies of old and new examples of each grammatical form are kept
7. Repeat until all utterances are analyzed	
8. Print out summary of data	

EXAMPLES

SAMPLES

Nancy, I get cookie Want cookie, please

CLAUSES

Clause	Syntactic Form	New/ Old	Trained	# Occur
I get cookie	Pro V N	New	No	1
Want cookie	V N	Old	Yes	2

TRAINED FORMS

Syntactic Form	Examples
N V	Boy eat Dog run
Pro V N	I want car

CLAUSE DICTIONARY

Clause	Syntactic Form	First Date	Last Date	# Occur
I want ball	Pro V N	9/18/78	9/18/78	1
Boy sit	N V	9/20/78	9/20/78	2
I get cookie	Pro V N	9/27/78	9/27/78	1

CLAUSES FOUND IN SAMPLE

Date: 9/27/78
Setting: LPP

PRO V N

Clause	New/Old	Trained?	# Occur
I get cookie	New	Partial	1
I want car	Old	Identical	2

Nominals. Two measures of nominals were made. Occurrences of new nominals in the child's repertoire were noted to provide a direct measure of the acquisition. Mean number of nominals per sentence were determined to provide a measure of diversity of the child's vocabulary.

Verbs. Both rate of acquisition (novel occurrences) of verbs and number per sentence were tracked. Verbs per utterance is an excellent indicator of complexity of a child's grammar.

Modifiers. Modifiers included adjectives and adverbs. These words are used increasingly as a child gains linguistic sophistication and begins specifying desires and observations more precisely. Acquisition of new forms and mean number per sentence were determined.

Function Words. Words, such as articles and prepositions, clarify meaning in a sentence. Their use reflects further sophistication by the subject. Both acquisition of new forms and mean number per sentence were tracked.

The computer program calculated each of these complexity variables for each verbatim sample. Changes in variables over time are discussed in the results section. Complexity data are presented graphically in Appendix 5 for each subject.

5. Rate Analysis. The application of the rate code has been described previously and is presented in detail in Appendix 2. This code facilitated the tracking of several "social speech" variables representing important measures of the communication situation. The rate code yielded four measures described below.

Rate of Adult Verbalization. This measure indicated the demand characteristics of the generalization environments in which subjects were observed in. Low rates of adult verbalizations indicate few requests for language, and few opportunities for generalization. High adult verbalization rates may indicate a supportive environment for generalization because the child has many opportunities to participate in verbal interactions. Possibly, increases in rates of adult verbalizations directed to a particular child over time may reflect improvements in the child's social-language skills that make him a better person for the adult to talk to.

Child Initiations. These are verbalizations by the child not immediately preceded by a verbalization from an adult or peer. Increases in initiations may show that the child is becoming a productive language user in the truest sense. He or she is using language not only to respond to other verbalizations, but to begin and conduct conversations.

Total Child Verbalizations. This represents a very straight-forward index of the child's rate of productive speech usage.

Percent of Obligatory Occasions Responded To. Obligatory speech situations are those in which the subject is required to respond with a vocalization: adults or peers asking the subject questions requiring other than a yes/no answer, or when they mand the child (give an instruction for verbalization: "Tell me what you're doing"), or when they directly model a verbal response for the child to imitate. This variable is a measure of the responsiveness of the child in various demand situations. The number of those opportunities provided to the child, as an index of the demand characteristics of the environment, is measured concurrently.

Rate measures were used to compare various generalization environments studied and provide a possible correlative explanation of variances in generalization levels across environments. However, the primary purpose of the rate measures was to provide another descriptor of students' communication development over time with an emphasis on the social/communicative rather than structural aspects of language. It was not possible to conduct rate observations concurrent with every verbatim observation. The longitudinal rate data for each subject are discussed in the results section and presented graphically in Appendix 5.

6. Standardized Measures. All subjects were assessed regularly on a battery of standardized language development tests. The assessments provided a secondary measurement of language training effects and allowed implications of the longitudinal results to be applied to other children of comparable disability levels. Furthermore these measures provide a basis for comparing subjects with experiments.

Scores on standardized tests can be found in the subject descriptions presented previously, and changes in each child's assessment scores are included in the results section along with the primary generalization data.

The assessment tests were administered to each child by that child's language trainer. The Peabody Picture Vocabulary Test (Dunn, 1965), the Houston Test for Language Development (Crabtree, 1963), and the Test for Auditory Comprehension of Language (Carrow, 1973) were given to most subjects; the Ski-High Receptive Language Test (Longhurst, Briery & Emery, 1974) was used with minimally skilled children. Detailed descriptions of each test are provided in Appendix 4.

Reliability

Extensive reliability observations were conducted on both the verbatim observation system and the rate code observation system. Reliability observations were taken between observers across different children and different settings. To calculate reliability, observers determined agreements and disagreements, added these sums together

and divided this sum into the total number of agreements found to yield a reliability coefficient. The exact formula used was:

$$\frac{\text{Agreements}}{\text{Agreements and Disagreements}} \times 100 = \% \text{ Reliable}$$

For the verbatim observations reliability was taken on the segmentation of utterances into meaningful linguistic units and on the recording of the actual words spoken analyzed on a morpheme by morpheme basis. For a given reliability assessment, each observer made an independent record during the same observation. When these records were complete, they were compared for agreements and disagreements in terms of morpheme and correct segmentation. The specific rules used can be found in Appendix 2.

For the rate code observations reliability was taken on the exact recording and coding of various verbal events defined in the code, in the exact order in which they occurred. All behaviors defined by the code were included in this analysis and reliability was scored for each category. The exact rules used to determine rate reliability can be found in Appendix 2.

In the remainder of this section reliability data are presented for each research site.

KNI. Reliability on the use of the rate code at KNI is presented in Table 6 below. Reliability is organized on the table by setting, observer and child.

Insert Table 6 about here

A total of 91 reliability assessments were made at KNI across the four settings observed in: the classroom, living unit, dining hall, and art classroom. Over-all reliability ranged from 75 percent to 84 percent agreement across these settings. Reliability was also assessed across seven different observers who at one time or another observed in these settings. Their individual reliability averages ranged from 67 percent to 83 percent agreement. A total of 10 children were observed in the course of reliability assessments. Reliability across these subjects ranged from 69 percent to 95 percent agreement. Over-all reliability for the rate code at KNI averaged 77 percent.

Reliability for verbatim observations, assessed by individual observers, is presented in Table 7 below. Reliability data is shown for morphemes and segmentation.

Table 6

KNI RATE CODE RELIABILITY

	# OBS.	AGREEMENTS	DISAGREEMENTS	%
By Setting				
Class	62	5125	1539	77
Unit	14	590	127	82
Dining Hall	14	551	183	75
Art	1	41	8	84
By Observer				
LO	27	2055	651	76
JK	27	1737	548	76
SM	17	1047	275	79
MZ	6	621	125	93
VR	6	507	109	82
PC	4	195	77	72
AB	4	145	72	67
By Child				
SC	29	1791	657	73
BY	28	2285	587	80
DX	12	831	162	84
JR	11	460	205	69
CL	3	297	90	78
SI	2	301	90	77
JH	2	159	13	92
TG	2	119	42	74
BT	1	36	9	80
SS	1	28	2	93
TOTAL	91	6307	1857	77

Insert Table 7 about here

Morpheme reliability data shown for 11 different observers. Reliability averages across these observers ranged from 76 percent to 91 percent agreement. Segmentation reliability is shown for four observers. It ranged from 94 percent to 98 percent agreement.

Verbatim reliability by child is shown in Table 8 below. Again, reliability is broken down for morphemes and segmentation.

Insert Table 8 about here

Data is shown for 15 subjects, four of whom did not participate in the generalization analysis. Morpheme reliability across subjects ranged from 77 percent to 100 percent agreement. Segmentation reliability ranged from 90 percent to 100 agreement.

Verbatim reliability data is presented by setting in Table 9 below:

Insert Table 9 about here

Generalization data for KNI subjects is presented for four of the five settings represented (no home data is presented). Across these four settings morpheme reliability ranged from 82 percent to 89 percent agreement. Segmentation reliability ranged from 96 percent to 98 percent agreement across these four settings.

Lawrence. Reliability on the use of the verbatim observation system across observation settings is presented in Table 9 above. Morpheme reliability at LPP averaged 86 percent agreement while home morpheme reliability averaged 74 percent and segmentation reliability averaged 96 percent agreement.

Insert Table 10 about here

Verbatim reliability was taken across 22 children, nine of whom were not subjects in the longitudinal generalization analysis. Morpheme reliability across these subjects ranged from an average of 68 percent to 95 percent agreement. Segmentation reliability across 17 subjects ranged from 76 percent to 98 percent agreement.

Table 7

KNI VERBATIM RELIABILITY

by observer

		morphemes			segmentation		
OBSERVER	# OBS.	AGREEMENTS	DIS-AGREEMENTS	%	AGREEMENTS	DIS-AGREEMENTS	%
J.K.	36	2409	468	84	---	---	-
S.M.	40	2713	466	85	---	---	-
A.B.	2	191	18	91	---	---	-
L.O.	27	1583	294	84	---	---	-
A.C.	4	164	51	76	---	---	-
V.R.	43	4260	455	90	---	---	-
P.V.	5	347	83	81	---	---	-
N.Z.	38	2561	419	86	344	5	98
P.C.	32	2175	322	87	513	10	98
D.U.	13	609	79	88	269	11	96
S.F.	22	1233	171	88	801	52	94

Table 8

KNI VERBATIM RELIABILITY by child

		morphemes			segmentation		
CHILD	# OBS.	AGREEMENTS	DIS-AGREEMENTS	%	AGREEMENTS	DIS-AGREEMENTS	%
S.C.	50	2764	325	89	322	4	99
T.G.	28	1194	193	86	295	10	97
C.L.	10	773	79	91	398	23	94
K.M.	9	647	72	90	47	1	98
B.H.	2	32	0	100	11	0	100
*B.Y.	82	6030	1626	79	267	17	94
S.I.	3	281	36	89	48	3	94
W.W.	2	249	32	89	102	11	90
D.X.	15	322	42	88	60	1	98
*S.S.	8	696	44	94	100	3	97
J.M.	19	713	98	88	178	2	99
B.T.	5	507	102	83	---	---	--
*J.R.	13	403	60	87	---	---	--
K.O.	8	397	33	92	300	11	96
*S.R.	13	276	81	77	---	---	--

*Subject not included in analysis of generalization

Table 9

VERBATIM RELIABILITY
by setting

KNI

		morphemes			segmentation		
SETTING	# OBS.	AGREEMENTS	DIS-AGREEMENTS	%	AGREEMENTS	DIS-AGREEMENTS	%
Living Unit	49	2447	417	85	279	7	98
Class	154	12193	1885	86	1699	73	96
Dining Hall	43	1754	389	82	117	4	97
Art Class	7	456	58	89	33	1	97
Home	7	177	56	76	---	---	-

LAWRENCE

		morphemes			segmentation		
SETTING	# OBS.	AGREEMENTS	DIS-AGREEMENTS	%	AGREEMENTS	DIS-AGREEMENTS	%
LPP	46	4432	717	86	---	---	-
Home	4	802	276	74	422	18	96
Other	2	14	9	62	10	0	100

Table 10

LAWRENCE VERBATIM RELIABILITY by child

CHILD	# OBS.	morphemes AGREEMENTS	morphemes DIS-AGREEMENTS	morphemes %	segmentation AGREEMENTS	segmentation DIS-AGREEMENTS	segmentation %
M.J.	31	2398	571	81	462	84	84
D.A.	25	2027	516		700	72	91
J.C.	13	1418	478	75	423	48	90
L.C.	13	595	80	88	458	32	94
*M.I.	11	1277	260	83	---	---	--
J.W.	11	1233	255	83	---	---	--
*B.C.	9	2362	435	84	481	80	86
*B.S.	9	752	210	78	---	---	--
K.S.	7	604	97	85	240	7	97
*J.O.	6	984	255	79	209	17	92
W.A.	6	381	116	76	152	34	82
J.I.	6	118	14	89	56	1	98
*K.C.	5	354	81	81	---	---	--
*J.R.	5	278	43	86	---	---	--
*B.H.	5	783	155	83	170	16	91
D.N.	5	387	91	80	198	17	92
C.U.	5	290	52	84	189	15	92
D.K.	3	74	34	68	68	10	87
C.Z.	1	81	13	86	69	7	91
*B.T.	1	463	28	95	115	12	91
*D.D.	1	135	33	81	38	4	91
*T. L.	1	23	2	92	14	7	67

*Subject not included in the analysis of generalization

Verbatim reliability across observers is presented in Table 11 below.

Insert Table 11 about here

Morpheme reliability across 21 independent observers ranged from 74 percent to 89 percent agreement. Segmentation reliability across 12 observers ranged from 79 percent to 94 percent agreement.

Rate code reliability by child is presented in Table 12 below.

Insert Table 12 about here

Rate code reliability is summarized by four categories: teacher behavior, child behavior, consequent behavior, and overall. Data is shown for 19 children. Reliability on teacher behavior ranged from 61 percent agreement to 90 percent agreement. Child behavior reliability averages ranged from 75 percent agreement to 95 percent agreement. Consequent behavior reliability averages ranged from 35 percent to 100 percent agreement. Over-all reliability averages ranged from 72 percent agreement to 90 percent agreement.

Rate code reliability by observer is presented in Table 13 below.

Insert Table 13 about here

Data is shown for 12 observers. Overall reliability averaged 79 percent agreement and ranged from 68 percent to 84 percent agreement.

Parsons. Overall reliability data on the verbatim observation system and the rate code observation system are presented in Table 14 below for the Parsons site.

Insert Table 14 about here

Reliability on the verbatim code across subjects ranged from 82 percent to 95 percent agreement, with an overall average of 89 percent. Rate code reliability averages for the eight subjects ranged from 79 percent to 99 percent agreement and averaged 89 percent overall.

Summary. A large number of reliability assessments were made on the verbatim and rate code reliability systems employed in the longitudinal

Table 11

LAWRENCE VERBATIM RELIABILITY
by observer

		MORPHEMES			SEGMENTATION		
OBSERVER	# OBS.	AGREEMENTS	DIS-AGREEMENTS	%	AGREEMENTS	DIS-AGREEMENTS	%
M.S.	42	3520	535	87	----	----	-
S.R.	25	2269	322	88	----	----	-
R.B.	17	1251	213	85	----	----	-
B.A.	34	2168	561	79	----	----	-
A.C.	3	399	139	74	----	----	-
C.A.	9	510	137	82	----	----	-
A.E.	11	720	224	76	----	----	-
E.R.	14	981	252	80	----	----	-
R.M.	15	1887	499	79	----	----	-
M.B.	4	202	52	80	164	28	85
B.J.	92	10301	2136	83	3844	408	90
J.M.	10	1333	358	79	398	49	89
M.R.	17	1543	453	77	439	39	92
R.M.	11	1063	214	83	312	80	80
M.J.	9	1562	396	80	407	64	86
J.J.	18	2441	591	80	1045	72	94
J.S.	7	613	76	89	236	21	92
S.S.	6	636	100	86	195	14	93
S.J.	7	537	100	74	257	19	93
J.M.	14	1021	122	89	476	29	94
M.M.	1	341	80	81	79	21	79

Table 12

LAWRENCE RATE CODE RELIABILITY

By Child

CHILD	# OBS.	TEACHER BEHAVIOR			CHILD BEHAVIOR			CONSEQUENT BEHAVIOR			OVERALL		
		Agreements	Disagreements	%	Agreements	Disagreements	%	Agreements	Disagreements	%	Agreements	Disagreements	%
MJ	19	283	115	71	652	132	83	63	38	62	998	285	78
DH	14	162	43	79	145	25	85	10	5	67	317	73	81
WA	12	225	63	78	378	90	81	59	34	63	664	184	78
DA	10	327	86	79	542	116	82	50	42	54	919	244	79
JO	7	122	43	74	236	48	82	54	35	61	524	93	77
BC	6	112	31	78	270	70	79	39	20	66	421	121	78
DK	5	74	18	80	150	19	89	6	9	40	230	46	83
BS	5	158	29	84	221	44	83	49	14	77	428	87	83
KS	4	64	11	85	64	17	79	3	4	43	131	32	80
CZ	4	34	11	75	77	22	77	5	9	35	116	43	72
CU	4	141	30	82	145	23	86	27	15	64	313	68	82
JI	4	117	18	87	114	6	95	34	7	83	265	31	90
DD	3	60	6	90	159	19	89	10	9	52	229	34	87
LC	3	109	11	84	136	14	91	34	16	68	279	51	85
BH	2	43	12	78	59	8	88	9	5	64	111	25	81
CY	2	27	17	61	58	8	87	6	3	66	91	28	76
JW	2	68	14	82	72	23	75	15	10	60	155	47	76
JC	2	19	7	82	29	3	91	5	1	80	98	16	86
SQ	1	9	1	90	12	3	80	4	0	100	25	4	86

Table 13

LAWRENCE RATE CODE RELIABILITY

By Observer

OBSERVER	# OBS.	TEACHER BEHAVIOR			CHILD BEHAVIOR			CONSEQUENT BEHAVIOR			OVERALL		
		Agreements	Disagreements	%	Agreements	Disagreements	%	Agreements	Disagreements	%	Agreements	Disagreements	%
RL	92	1683	451	79	2953	569	84	362	212	63	4998	1232	80
CA	52	1055	373	74	1726	475	78	326	154	68	3107	1002	76
JK	45	1032	269	79	1785	285	86	230	138	63	3047	692	81
SP	30	616	157	80	1045	209	83	165	84	66	1826	450	80
GW	27	483	124	80	865	191	88	127	63	67	1475	378	80
ST	20	407	189	68	631	206	75	137	69	67	1175	464	72
AB	19	287	101	74	556	129	81	48	62	44	891	292	75
MR	12	175	48	78	399	42	90	52	26	67	626	116	84
JO	12	291	65	82	402	110	79	68	28	71	761	203	79
DO	10	241	74	77	299	63	83	54	29	65	594	166	78
RZ	7	71	35	67	182	66	73	54	17	76	307	118	72
SY	6	69	32	68	71	32	69	6	6	50	146	70	68
TOTAL	332	6410	1918	77	10914	2377	82	1629	888	65	18953	5183	79

Table 14

OBSERVATIONAL RELIABILITIES
PARSONS SITE

Student	Number of Verbatim Code Observations	Dates of Observation	Number of Reliabilities	% of Total Reliability	Number of Rate Code Observations	Dates of Observation	Number of Reliability	% of Total
K.M.	550	9-77 to 7-79	48	95%	* 5	9-77	1	89%
W.P.	240	9-78 to 7-79	19	90%	* 5	9-78	1	97%
J.R.	150	10-78 to 6-79	17	88%	* 5	10-78	1	99%
M.G.	530	9-77 to 7-79	42	92%	* 5	9-77	2	92%
C.W.	660	10-76 to 5-79	63	85%	35	1-77 to 4-77	9	80%
C.R.	280	9-77 to 8-78	20	89%	* 5	9-77	1	79%
T.B.	330	1-77 to 7-77	51	92%	80	1-77 to 4-77	21	87%
R.B.	110	7-76 to 5-77	15	82%	25	2-77 to 4-77	5	88%

*Probe data

generalization research . The results of these assessments are only summarized in this section. These summaries show that with few exceptions the measurement systems used appeared to be sufficiently reliable to support a meaningful analysis of the data they provided.

Results

In the following section the results of the longitudinal analysis of language generalization are presented for the KNI, LPP and Parsons sites. The results for each subject, 32 in all, are briefly presented. Each of these presentations attempts to characterize the child's data as concisely as possible. Graphs of structure generalization are presented for each subject. Graphic presentations of complexity and rate code data (where available) are presented for each subject in Appendix 5. However, significant findings of the complexity analysis and rate code analysis are noted in the discussion of each child's results. At the completion of the presentation of the results for each setting the results for that setting are summarized and discussed. At the conclusion of the entire longitudinal results section a general discussion of the findings and their varied implications is presented.

A total of 87 figures are presented in this section. Each of these figures presents generalization data of a particular structure(s), taken from the natural environment observations. The same format is followed in each figure. Each is a cumulative graph of types and tokens of the structure represented. When a curve on the graph is moving upward the form in question was observed occurring. When the line is flat, the subject was not using the form. When only one line is present on the graph, all forms used by the subject were novel (had not been observed before). Where two parallel lines appear on the graph, the lower one represents types (novel occurrences) and the upper one represents tokens (all occurrences, novel and otherwise). The numbering on the vertical axis of the graphs varies depending on the rate displayed by the subject in question for the particular form in question. The horizontal axis represents either observations across time or blocks of observations across time. Where blocks are used this was done because the number of observations taken was too large to represent each by a separate data point. So the data was blocked, usually into four observation sums, and the sums for these blocks graphed. Where small numbers in squares (3) are shown on the graph, these represent the implementation of training steps. The number in the square corresponds with the number of the step trained by the respective training program for that subject. Other variations that occur from graph to graph should be self-explanatory.

KNI Results

Generalization data were collected on 11 severely retarded children residing at the Kansas Neurological Institute. These data were taken in the children's classroom, dining hall, living unit, and for some subjects, in art class. Nine of the 11 subjects were trained on the Guess, Sailor, Baer language training program and the other two were trained on the Stremel and Waryas training program. The results for each subject are briefly described below. Graphic representations of the subject complexity data can be found in Appendix 5 as can rate code and other data where relevant. A discussion of the results for this population follows the results presentation.

Subject: S.C. Sex: Male Age: 12.1 to 14.7

Training

S.C. was admitted to KNI in October, 1971. Training on the Guess, Sailor, and Baer program began with step 3 and proceeded through step 22. Forty-three nouns were trained. Steps 21 and 23 were not trained because they involves yes/no responses with which S.C. had extreme difficulty. Criterion was not reached on steps 15, 17 and 19. The mean time spent training each step was 13 sessions.

Assessments

The results of the PPVT, STACL and Houston (Part I) are presented below.

	PPVT	STACL	Houston
March 1977	M.A. 2-3	----	----
April 1977	----	----	32 Mo. level
May 1977	----	Unscorable	----
September 1978	----	Unscorable	----
October 1978	M.A. 3-7	----	----

Word Generalization

S.C. was observed 317 times (dining hall--118; class--104; unit--95) from November, 1976, through May, 1977. Twelve trained nouns were observed during baseline. The word generalization ratios were: one occasion, 4/31 = .13; two occasions, 2/31 = .06; two settings, 2/31 = .06. S.C.'s vocabulary included 712 words.

Structure Generalization

Generalization data on the four functional forms are presented in Figures 2-4. There were no baseline data for any form because training began prior to the beginning of this project. Training accelerated S.C.'s use of "I want X" in all settings. During training the other forms occurred but his use of these forms was not maintained.

Complexity Effects

MLU increased slightly during the observation period (from 1.12 to 1.74). Upperbound was variable (range: three to seven morphemes). For brief periods during March and April, 1978, upperbound remained at seven morphemes. Other complexity measures were variable (no trends were apparent, except verbs per utterance increased from .10 to .30). The mean rates of nominals, modifiers, and function words were variable. The mean verb rate increased slightly.

Rate Effects

Ninety-three rate observations were taken in the fall of 1976 and the spring of 1978. S.C.'s total verbalization rate and initiation rate decreased over the observational period in all settings. Teacher verbalizations and consequent behaviors were higher in the class setting. The percentage of obligatories answered was high (between 60 and 70%).

Summary

Training accelerated S.C.'s use of the form "I want X." The complexity of S.C.'s language changed very little. The percentage of obligatories answered was high in all settings.

Subject: D.X. Age: Male Age: 14.2 to 16.11

Training

D.X. was admitted to KNI in September, 1970. Training on the Guess, Sailor, and Baer program began with step 1 and slowly progressed to step 14. The mean time spent training per step was 64 sessions. Criterion was reached on all steps except 1, 2, 7, 10, 13 and 14. Step 6 was not trained. Thirty-one specific nouns were also trained.

Assessments

The results of the PPVT, STACL, and Houston (Part I) are presented below.

Figure 2

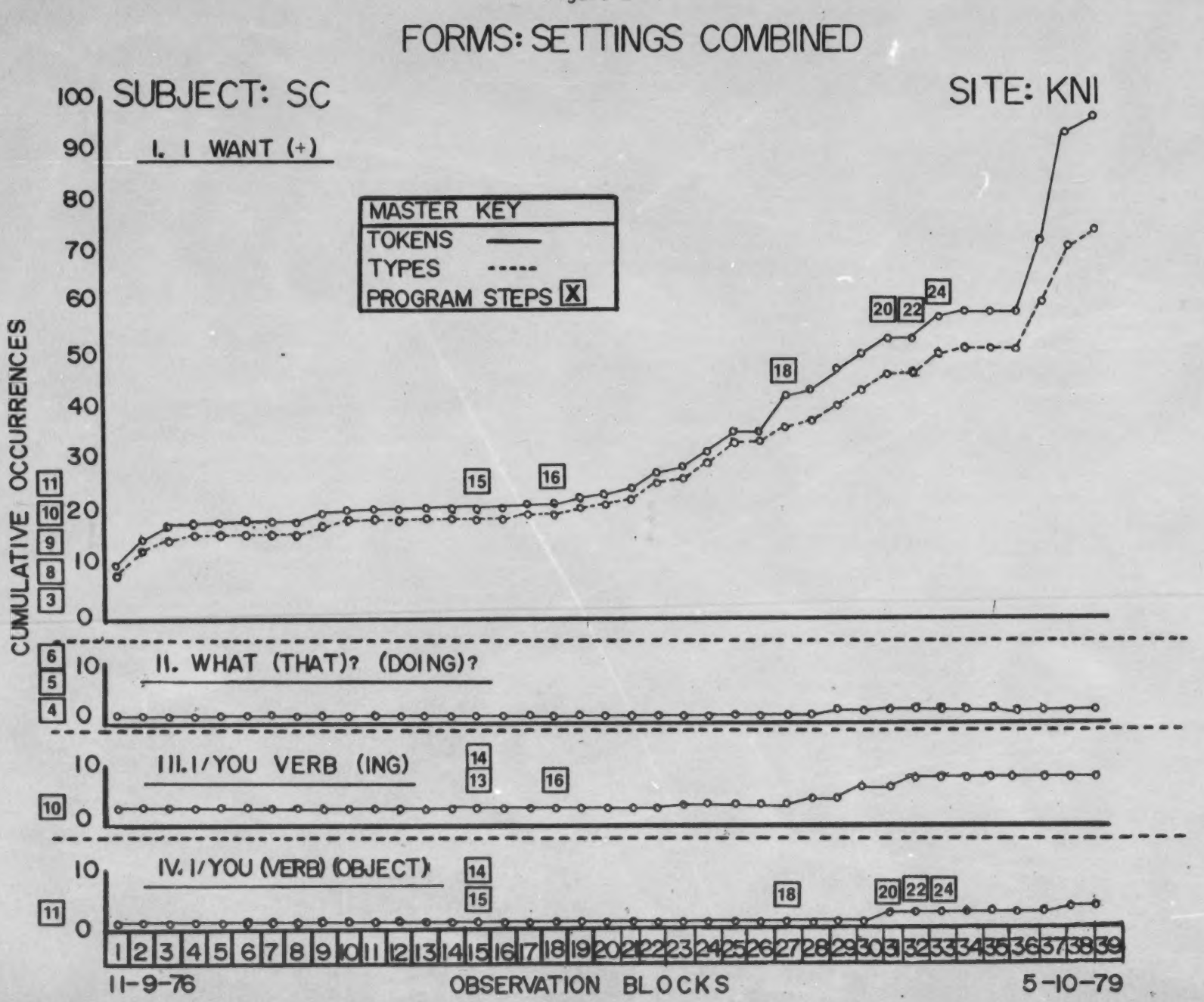

FORMS: SETTINGS COMBINED
SUBJECT: SC
SITE: KNI
I. I WANT (+)
MASTER KEY
TOKENS
TYPES
PROGRAM STEPS X
CUMULATIVE OCCURRENCES
II. WHAT (THAT)? (DOING)?
III. I/YOU VERB (ING)
IV. I/YOU (VERB) (OBJECT)
11-9-76
OBSERVATION BLOCKS
5-10-79

Figure 3

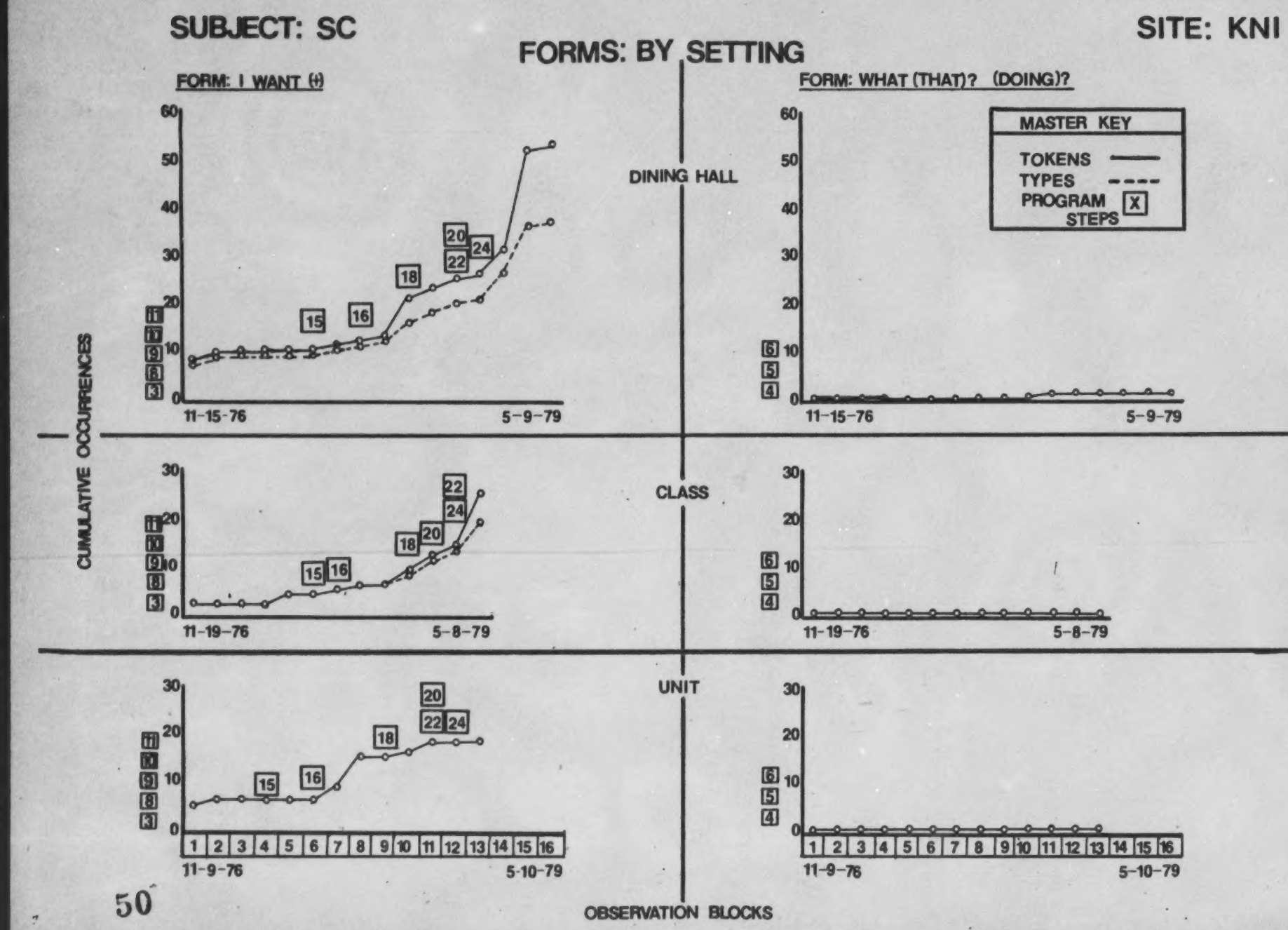

SUBJECT: SC
SITE: KNI
FORMS: BY SETTING
FORM: I WANT (+)
FORM: WHAT (THAT)? (DOING)?
MASTER KEY
TOKENS
TYPES
PROGRAM STEPS
DINING HALL
CLASS
UNIT
CUMULATIVE OCCURRENCES
OBSERVATION BLOCKS
11-15-76
5-9-79
11-19-76
5-8-79
11-9-76
5-10-79

Figure 4

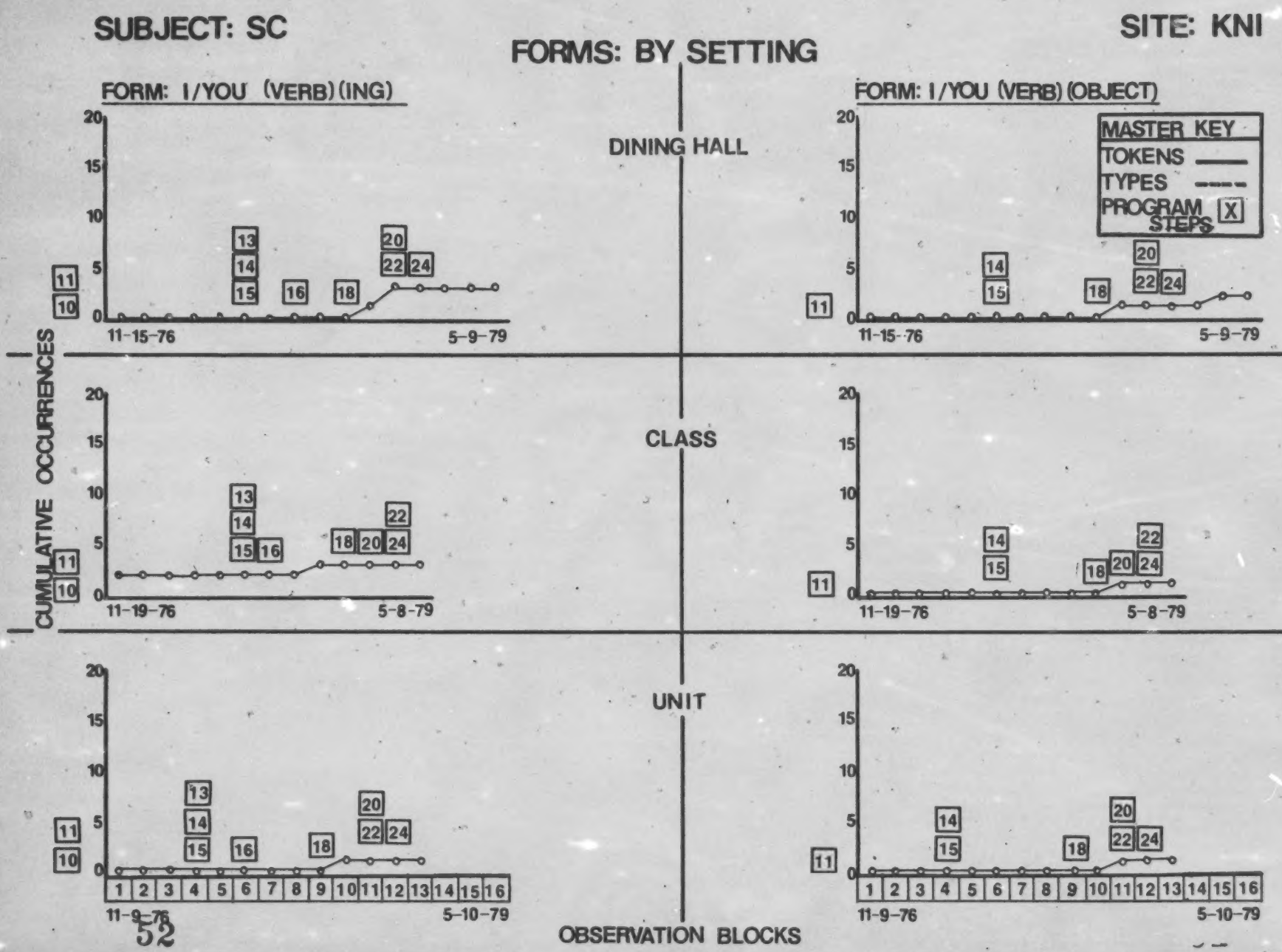
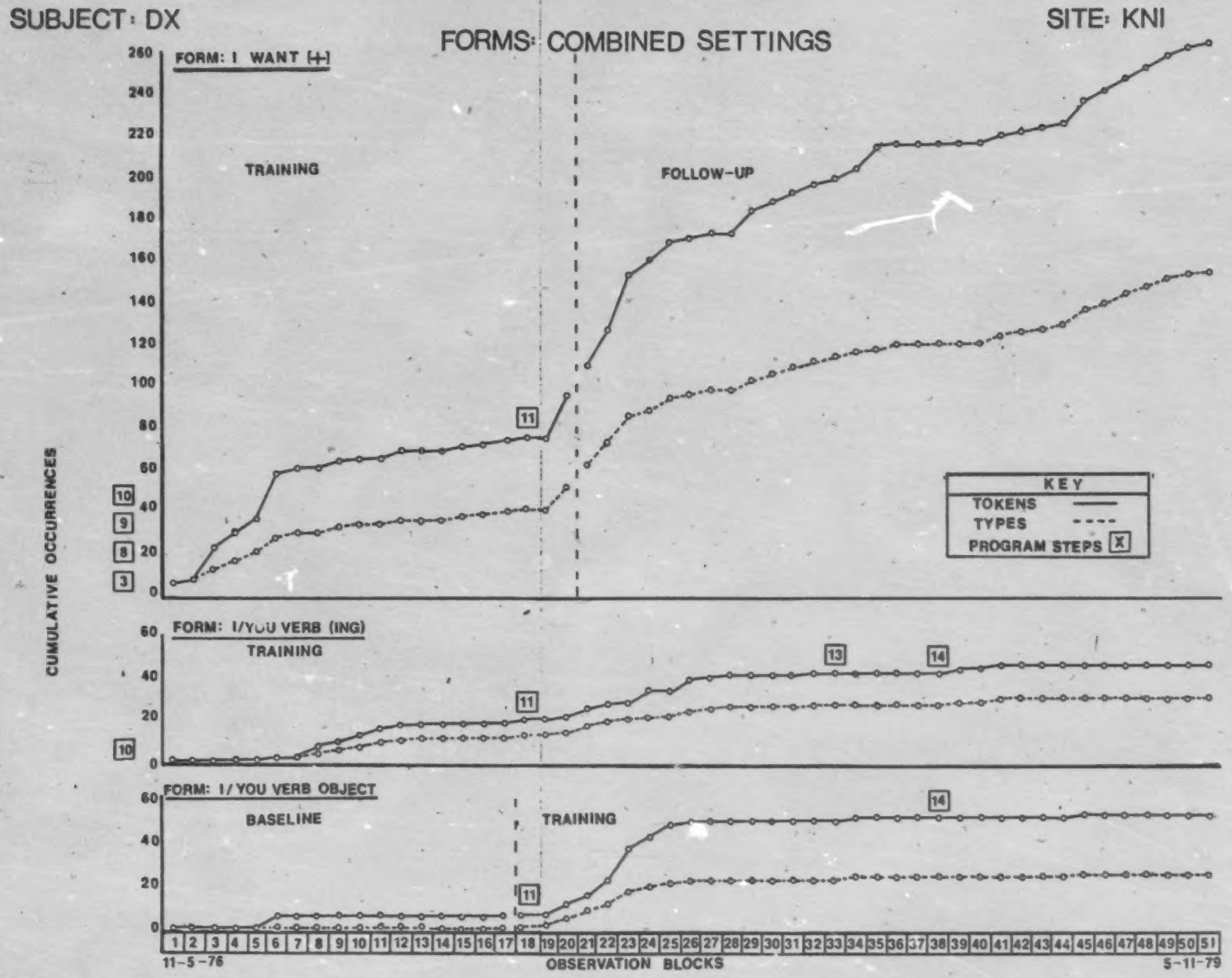
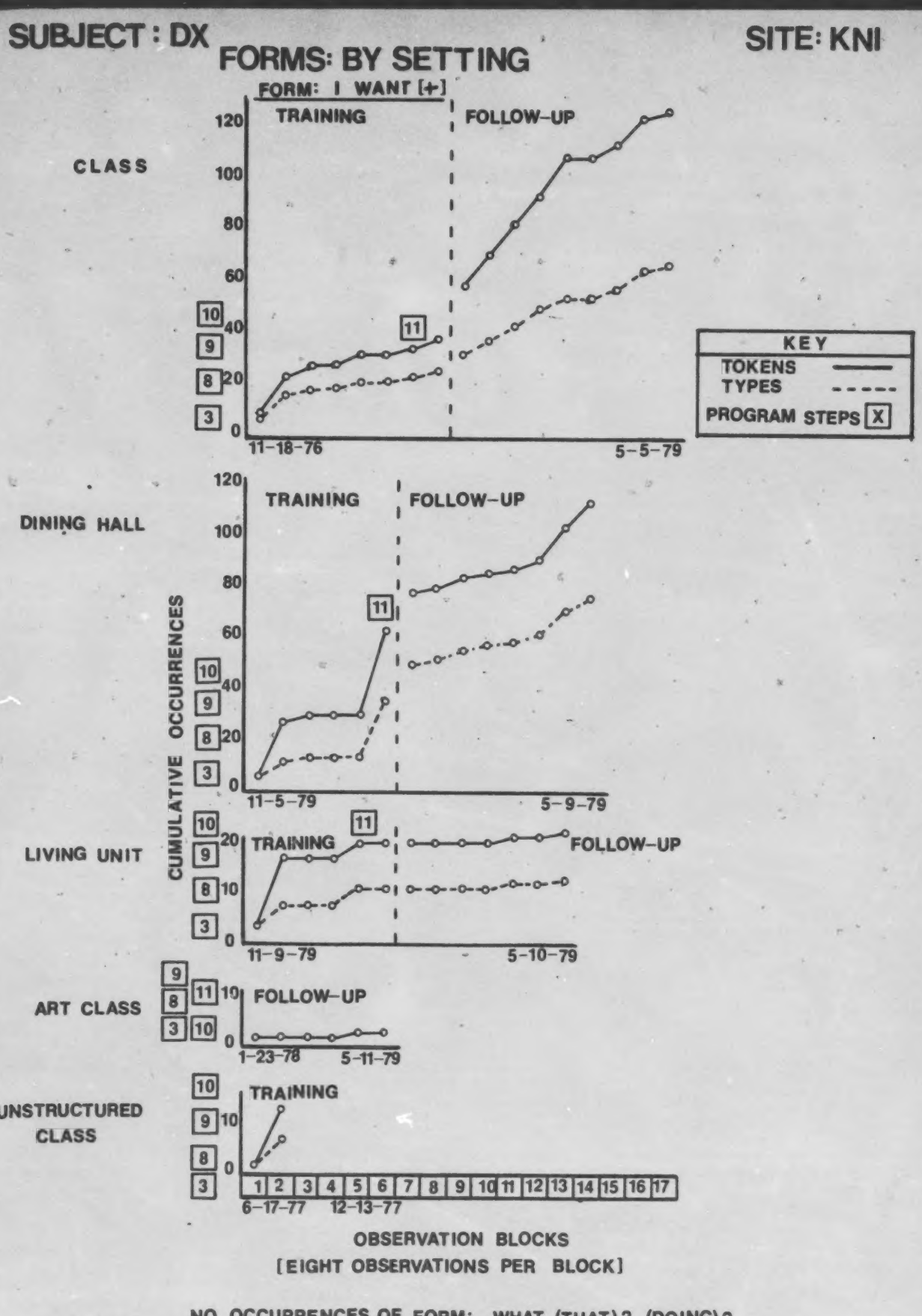

SUBJECT: SC
SITE: KNI
FORMS: BY SETTING
FORM: I/YOU (VERB)(ING)
FORM: I/YOU (VERB)(OBJECT)
MASTER KEY
TOKENS
TYPES
PROGRAM STEPS X
DINING HALL
CLASS
UNIT
CUMULATIVE OCCURRENCES
OBSERVATION BLOCKS
11-15-76
5-9-79
11-19-76
5-8-79
11-9-76
5-10-79

Figure 5


SUBJECT: DX
FORMS: COMBINED SETTINGS
SITE: KNI
FORM: I WANT [+]
TRAINING
FOLLOW-UP
KEY
TOKENS
TYPES
PROGRAM STEPS X
FORM: I/YOU VERB (ING)
TRAINING
FORM: I/YOU VERB OBJECT
BASELINE
TRAINING
CUMULATIVE OCCURRENCES
11-5-76
OBSERVATION BLOCKS
5-11-79
(EIGHT OBSERVATIONS PER BLOCK)



NO OCCURRENCES OF FORM: WHAT (THAT)? (DOING)?

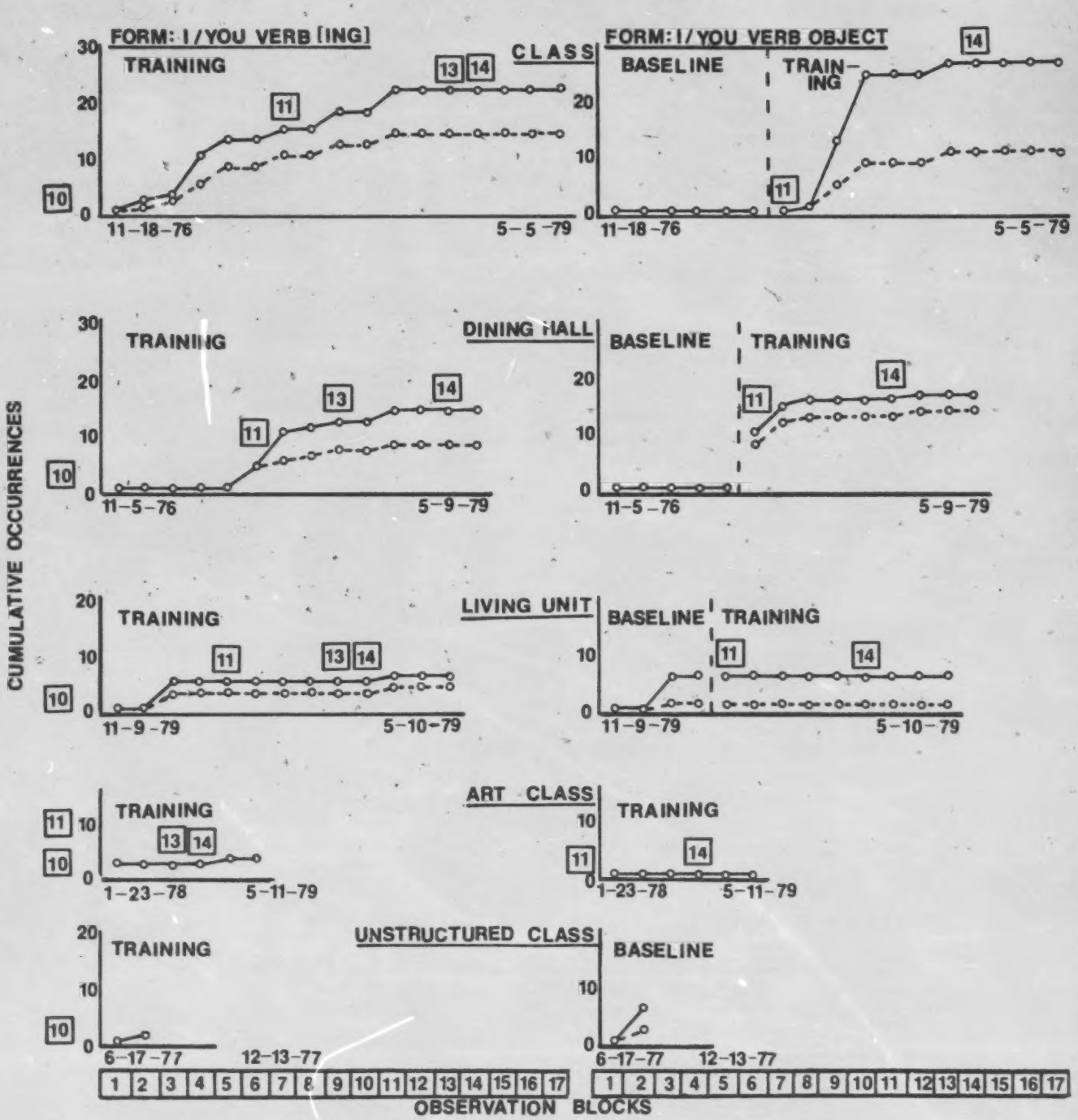
Figure 6

Figure 7

SUBJECT: DX

SITE: KNI

FORMS: BY SETTING



	PPVT	STACL	Houston
March 1977	M.A. 2-7	----	24 Mo. level
April 1977	----	Unscorable	----
September 1978	----	----	18 mo. level
October 1978	M.A. 2-0	Unscorable	----
July 1979	M.A. 1-11	Unscorable	----
August 1979	----	----	29 mo. level

Word Generalization

A total of 411 verbatim observations were taken from November, 1976, through May, 1979 (class--147; dining hall--113; living unit--107; art class--44). The word generalization ratios were: one occasion--14/31 = .45; two occasions--10/31 = .32; two settings--9/31 = .29. D.X.'s vocabulary included 261 words.

Structure Generalization

Training was conducted on all four functional forms. No baseline data were available for three of the forms because training began prior to the beginning of this project. During training on step 11, the occurrences of the form "I want X," accelerated in class and dining hall. Occurrences of I/You Verb(ing) accelerated in dining hall. The form I/You Verb (Object) occurred in the living unit before training. After training began, generalization to class and dining hall occurred but did not maintain. The form "What (that) (doing)?" was not observed in any setting. D.X.'s structure generalization data are presented in Figures 5-7.

Complexity Effects

MLU was variable and generally low, ranging from 1.0 to 2.9, with a decreasing trend. Upperbound revealed no trend, generally staying around three or four morphemes (range one to seven morphemes). D.X.'s utterances mainly consisted of nominals. Other complexity measures were low and variable with slightly decreasing trends. The mean rates of nominals, verbs, modifiers, and function words were very low and variable with no trends.

Rate Effects

A total of 115 rate observations were taken in the fall of 1977 and the spring of 1978. D.X.'s verbalization rate was very low in all settings. The highest verbalization rates were found in class. The percentage of obligatories answered averaged 40 percent in all settings.

Summary

D.X.'s verbalization rate was very low. Training effects (acceleration and generalization) were observed in the class and dining hall settings. The complexity and diversity of D.X.'s language changed little over the observational period.

Subject: B.T. Sex: Male Age: 12.8 to 14.1

Training

B.T. entered KNI in February, 1973. Training on the first step Stremel-Waryas program began in March, 1978. Verb-Noun (3-6-78 to 7-14-78, 19 exemplars) and Pronoun-Verb (11-6-78 to 1-18-78, 7 exemplars) forms were trained next. Criterion was reached on both structures.

Assessments

The results of the PPVT, STACL and Houston (Part I) are presented below.

	PPVT	STACL	Houston
October 1978	M.A. 3-0	Unscorable	35 mo. level

Word Generalization

B.T. was observed 195 times from October, 1977, to March, 1979, (class--62; living unit--63; dining hall--46; art class--24). Six trained verbs were observed to be used by the child during baseline. The word generalization ratios were: one occasion 2/9 (.22); two occasions, 2/9 (.22); two settings, 1/9 (.11) B.T.'s vocabulary included 732 words observation ended.

Structure Generalization

The trained structures were collapsed into one general class: Nominal-Verb/Verb-Nominal. This form occurred extensively during baseline. Generalized training effects were observed for the structure Pronoun-Verb in all settings. Baseline occurrences of the form Nominal-Verb/Verb-Nominal were all occurrences of the Verb-Noun form. B.T.'s structure generalization data is presented in Figures 8-10.

Complexity Effects

MLU was variable and changed little over time. It averaged just under 3.0 (range: 1.66 to 3.28). Upperbound followed the same pattern, generally around 7 morphemes (range: 5 to 10 morphemes). The number

Figure 8

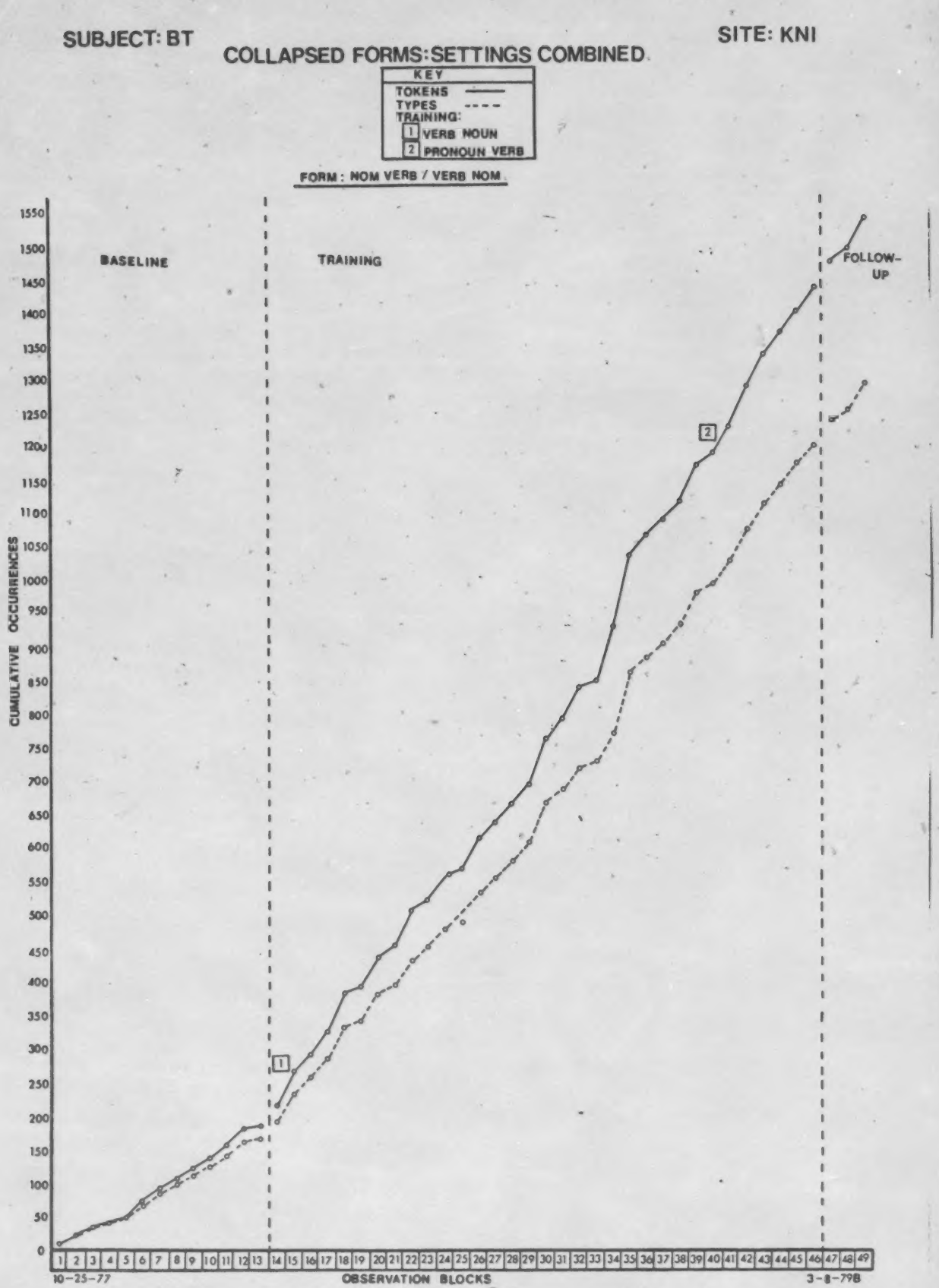

SUBJECT: BT
SITE: KNI
COLLAPSED FORMS: SETTINGS COMBINED
KEY
TOKENS
TYPES
TRAINING:
1 VERB NOUN
2 PRONOUN VERB
FORM: NOM VERB / VERB NOM
BASELINE
TRAINING
FOLLOW-UP
CUMULATIVE OCCURRENCES
OBSERVATION BLOCKS
10-25-77
3-8-79

Figure 9

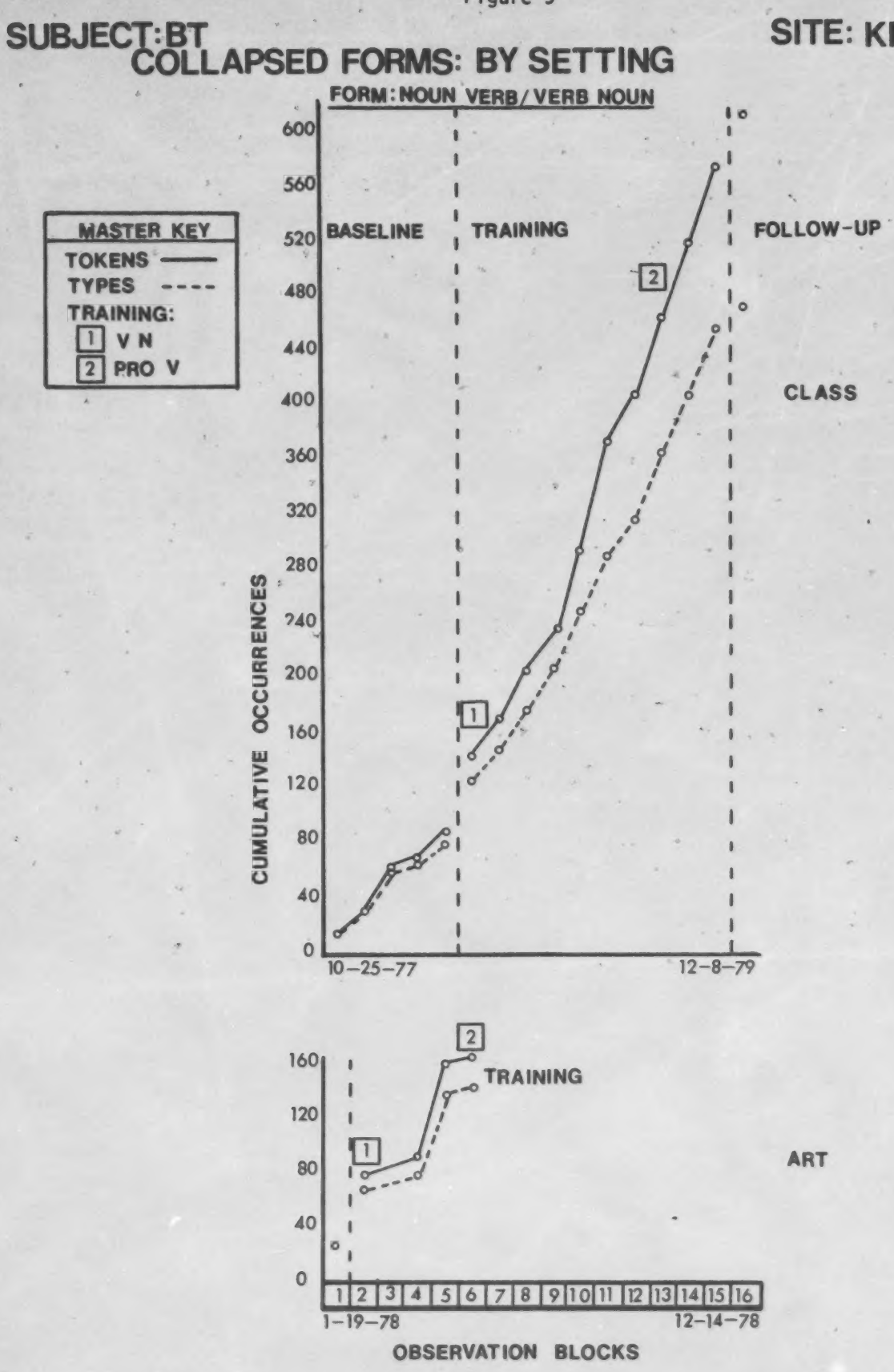
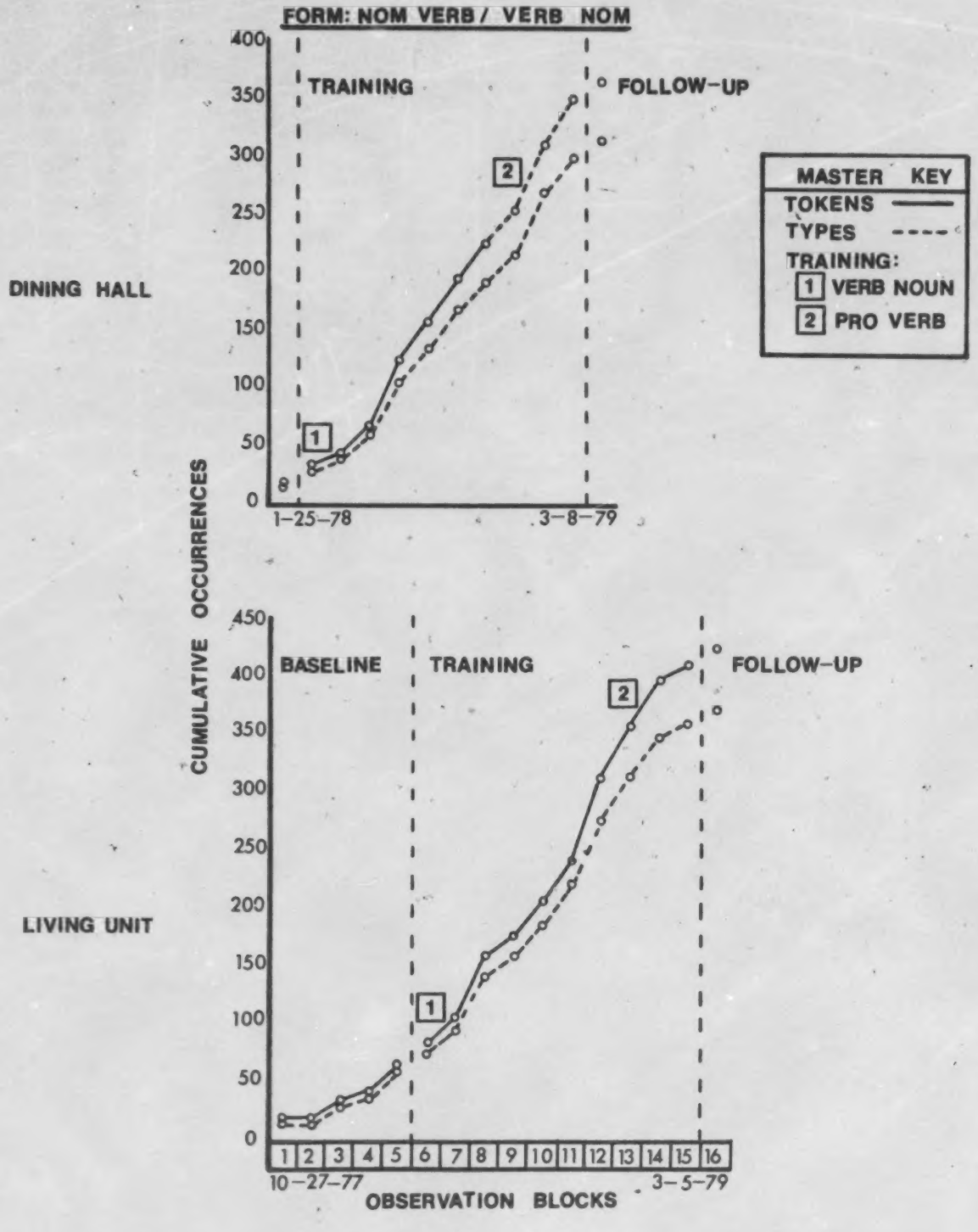

SUBJECT:BT
SITE: KNI
COLLAPSED FORMS: BY SETTING
FORM: NOUN VERB/VERB NOUN
MASTER KEY
TOKENS
TYPES
TRAINING:
1 V N
2 PRO V
BASELINE
TRAINING
FOLLOW-UP
CLASS
ART
CUMULATIVE OCCURRENCES
0
40
80
120
160
200
240
280
320
360
400
440
480
520
560
600
10-25-77
12-8-79
1-19-78
12-14-78
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
OBSERVATION BLOCKS

Figure 10

SUBJECT: BT

SITE: KNI

COLLAPSED FORMS: BY SETTINGS



of nominals per utterance increased slightly over time. Other complexity measures revealed variability but no trends.

Rate Code Effects

Thirty-eight rate code observations were taken from October, 1977, to December, 1977, dining hall--15; class--10; living unit--5; art class--8; B.T.'s total verbalization rate and initiation rate were high in all settings, especially class and art class. The mean percentage of obligatories responded to was 75 percent or more in all settings except the living unit.

Summary

Training on the structure Verb-Noun was inappropriate as there were many occurrences observed during baseline. Pronoun-Verb generalized to all settings soon after training commenced, however, the rate, complexity and diversity of B.T.'s language changed very little over time.

Subject: C.L. Sex: Male Age: 15.1 to 16.7

Training

C.L. entered KNI in September, 1970. Training in the Guess-Sailor-Baer program began in October, 1978, on step 15. Step 15 was soon discontinued and training on step 11 initiated instead, after which training proceeded through step 27. Criterion was not reached on steps 15, 17, 19, 21, 23, 24, 26 and 27, however, six of these steps trained the productive responses yes and no , which were not tracked in the longitudinal analysis.

Assessments

The results of the PPVT, STACL and Houston (Part I) are presented below.

	PPVT	STACL	Houston
October 1978	M.A. 2-1	Unscorable	31 Mo. level
July 1979	M.A. 2-0	Unscorable	----
August 1979	----	----	33 mo. level

Word Generalization

(Not applicable)

Structure Generalization

One hundred fifty-seven observations were taken from October, 1977, through May, 1979; class--52; dining hall--56; living unit--53; art class--26. Generalization data are shown in Figures 11-16. Generalization were observed on the form "I want X," in class and the living unit. Effects may also have occurred in other settings, but baseline data were not available for comparison in those settings. Slight training effects occurred on the form "What (that)? (doing)?" in class and dining hall. Effects on the form "I/You verb(-ing)" occurred in class. A strong effect on the form "I/You verb object" occurred in class. There were possible lesser effects in other settings.

Complexity Effects

C.L.'s language complexity changed little over the observational period. There were slight decreases in MLU, upperbound and rates of nominals, verbs and modifiers. Other complexity measures revealed virtually no change.

Rate Effects

Rate observations were taken during the spring of 1979. The rate of teacher verbalization was much higher in class settings and lowest in the living unit. The child's total verbalization rate was highest in class and living unit. The rate of initiations was highest in the living unit. Initiations in class settings made up a smaller proportion of the total verbalization rate than in the other two settings. The percentage of obligatory language situations responded to was high (70% in three of the settings and 53% in art class).

Summary

Clear training effects were observed in the class setting. Generalization may have occurred in other settings also. Standardized assessment and complexity measures indicated little change in overall language development.

Subject: K.O. Age: Male Age: 8.2 to 8.11

Training

K.O. was admitted to KNI in July, 1978. Training on the Guess, Sailor, Baer program began in September, 1978, with step 3 and proceeded through step 7. All steps were trained to criterion except step 7 (yes/no training).

Figure 11

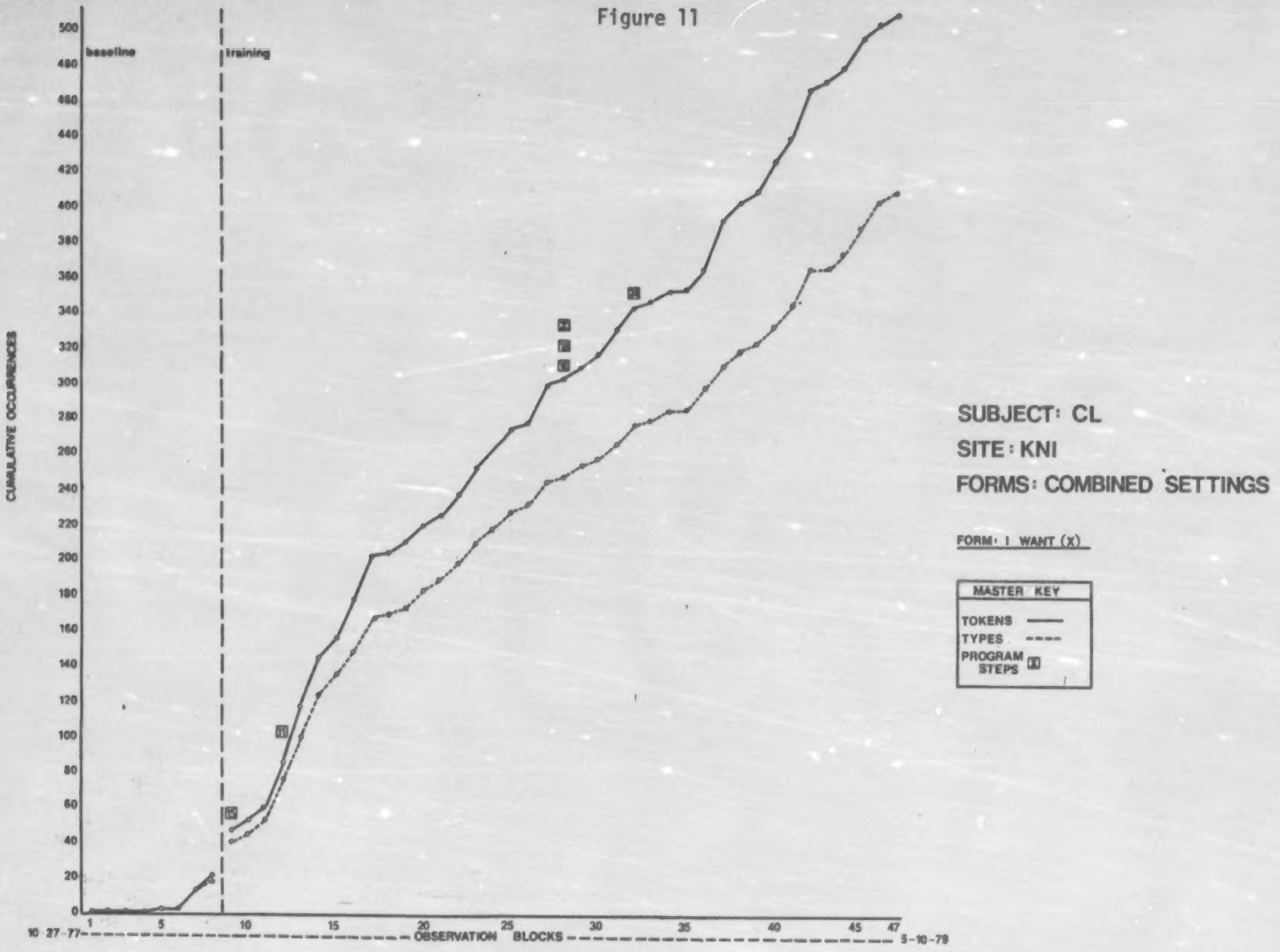
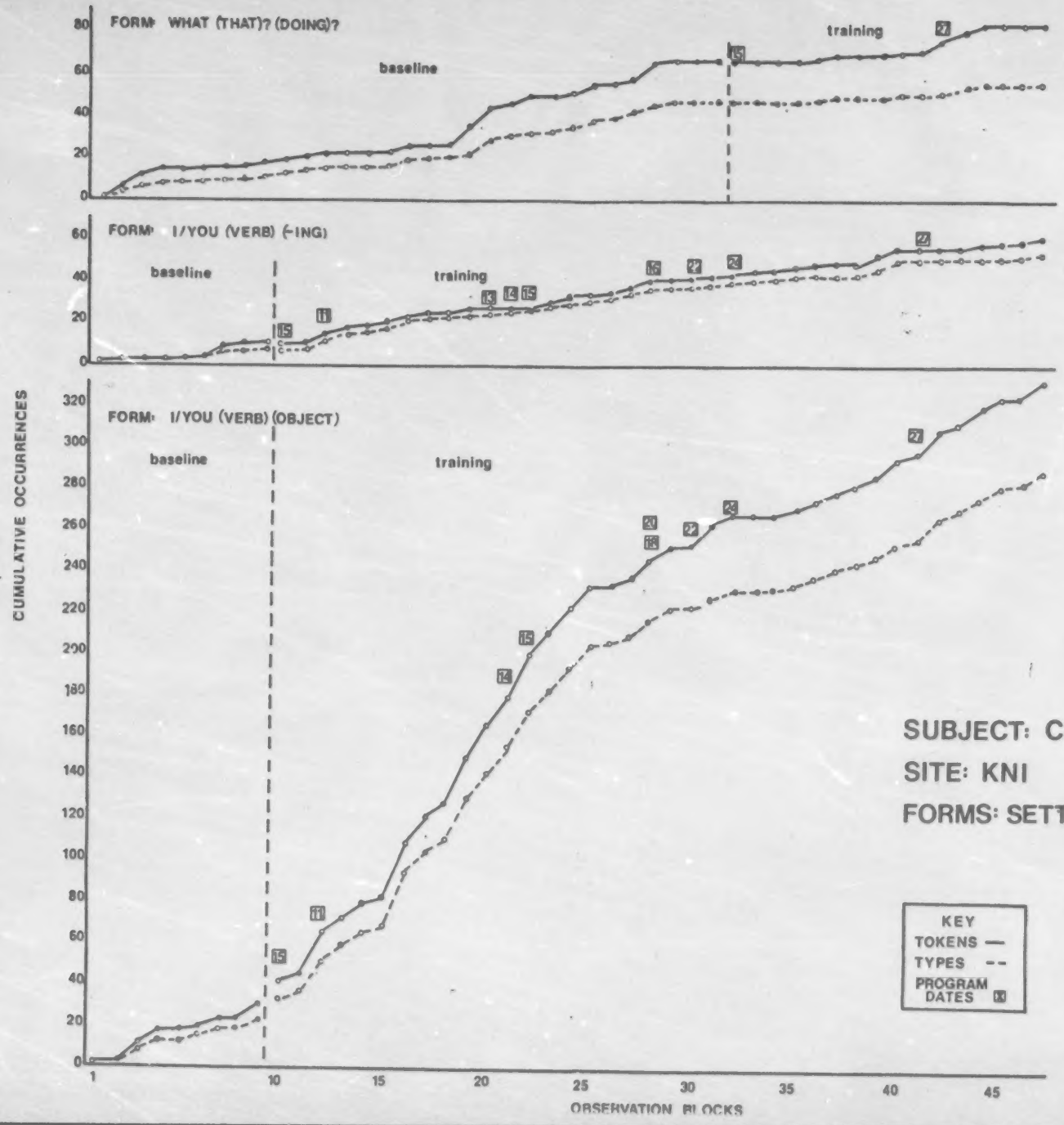

baseline
training
CUMULATIVE OCCURRENCES
OBSERVATION BLOCKS
10 27 77
5-10-79
SUBJECT: CL
SITE: KNI
FORMS: COMBINED SETTINGS
FORM: I WANT (X)
MASTER KEY
TOKENS
TYPES
PROGRAM STEPS

Figure 12


FORM: WHAT (THAT)? (DOING)?
baseline
training
FORM: I/YOU (VERB) (-ING)
baseline
training
FORM: I/YOU (VERB) (OBJECT)
baseline
training
CUMULATIVE OCCURRENCES
OBSERVATION BLOCKS
SUBJECT: CL
SITE: KNI
FORMS: SETTINGS · COMBINED
KEY
TOKENS —
TYPES --
PROGRAM DATES

SUBJECT: CL SITE: KNI

FORMS: BY SETTING

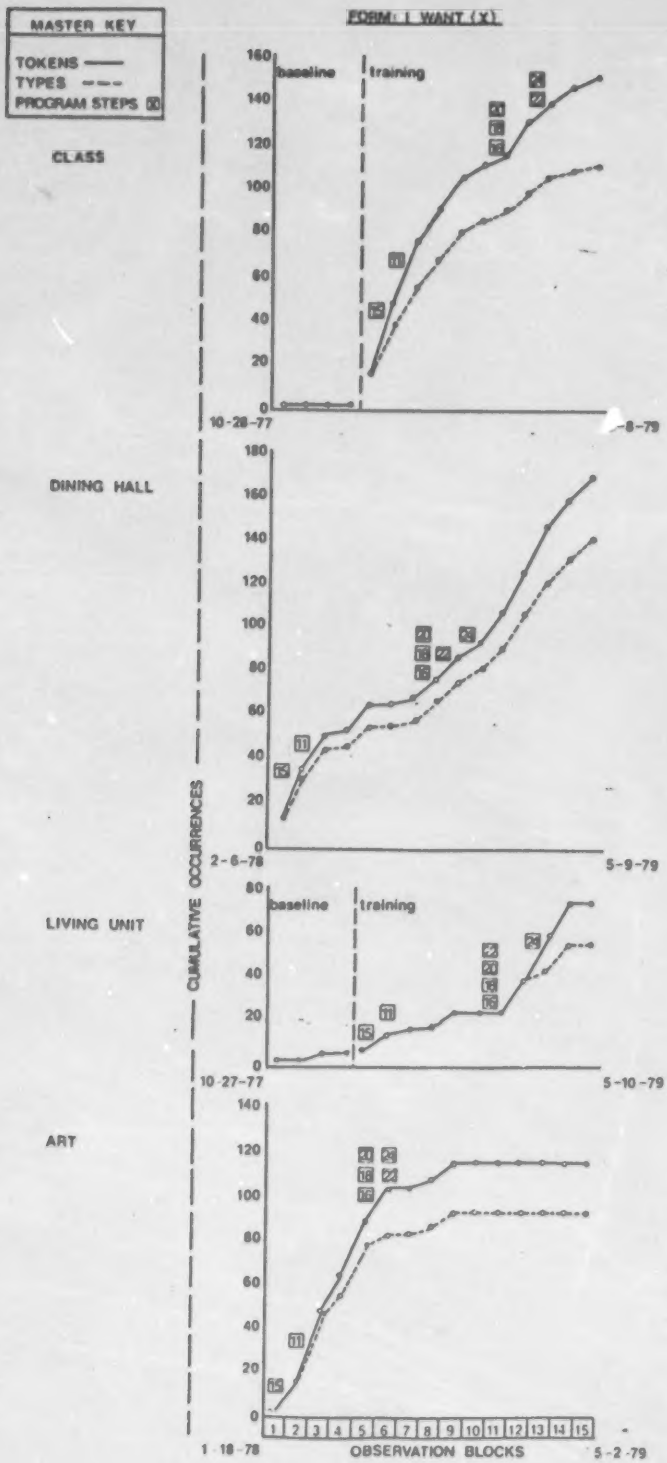


Figure 13

Figure 14

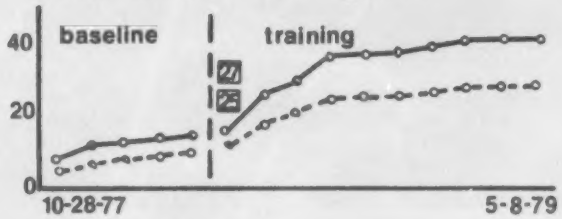
SUBJECT: CL SITE: KNI

FORMS: BY SETTING

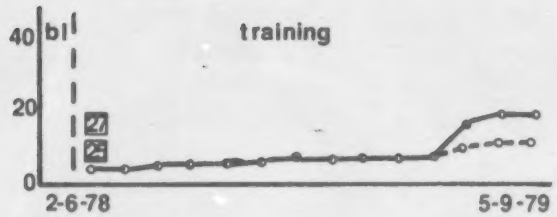
KEY
TOKENS ——
TYPES - - -
PROGRAM DATES: [X]

FORM: WHAT (THAT)? (DOING)?

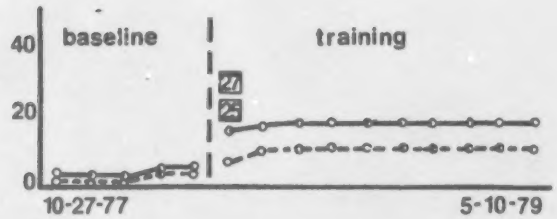
CLASS



DINING HALL



LIVING UNIT



ART

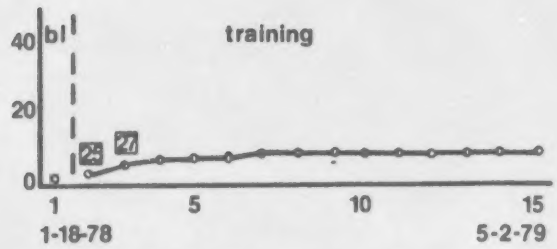


Figure 15

SUBJECT: CL

SITE: KNI

FORMS: BY SETTING

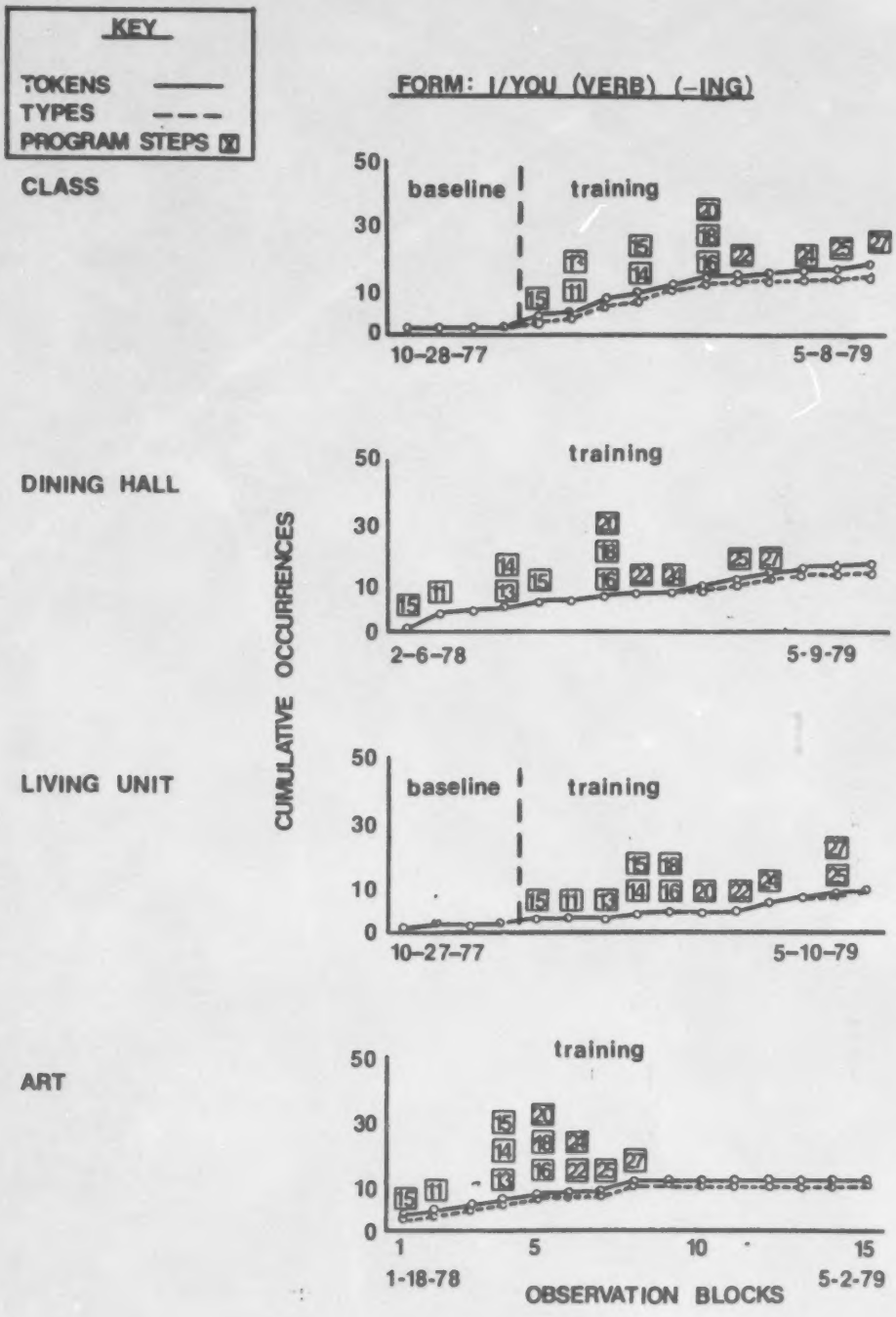


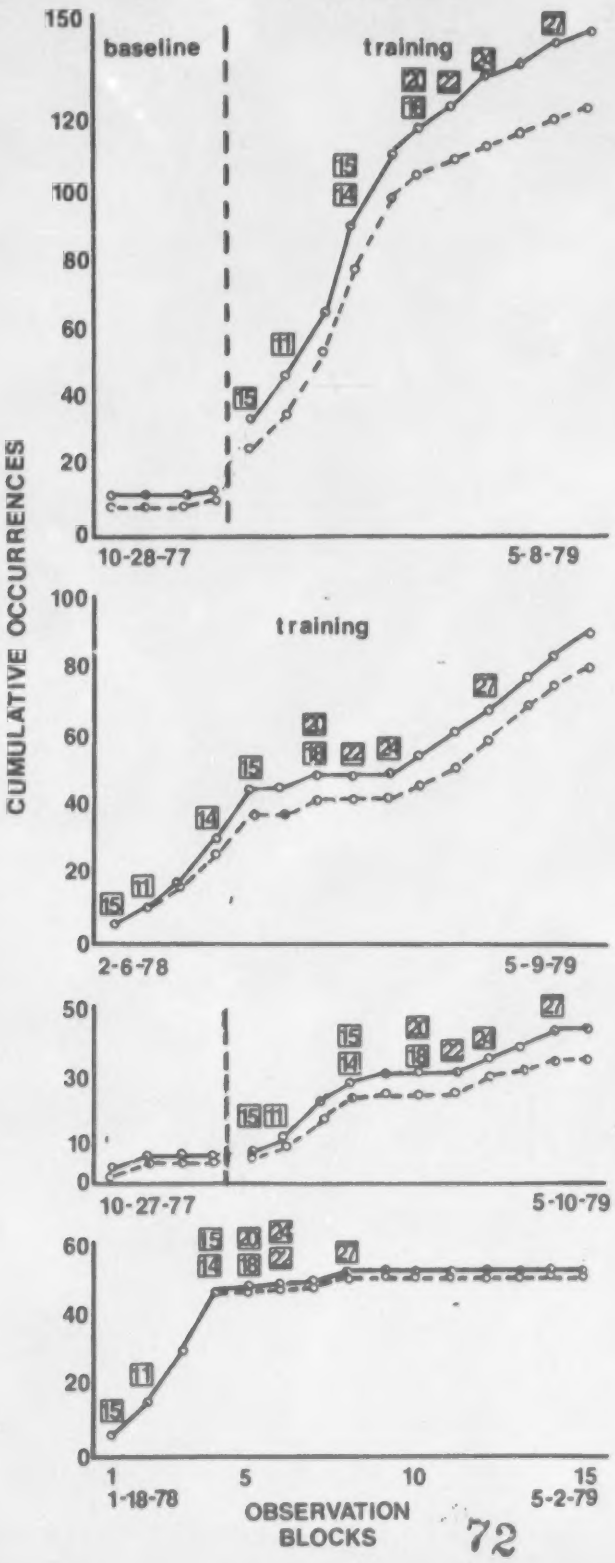
Figure 16

SUBJECT: CL **SITE: KNI**

FORMS: BY SETTING

KEY
TOKENS —
TYPES - -
PROGRAM DATES: X

FORM: I/YOU (VERB)(OBJECT)



Assessments

The results of the PPVT, STACL and the Houston (Part I) are presented below.

	PPVT	STACL	Houston
July 1979	M.A. 2-3	Unscorable	----
August 1979	----	----	28 mo. level

Word Generalization

(Not applicable) K.O.'s vocabulary included 184 words.

Structure Generalization

Thirty-eight verbatim observations were taken from January, 1979, through April, 1979, class--15; living unit--13; dining hall--10. Two forms were trained; "I want X" and "What (that)? (doing)?". The "I want X?" form was generalized to two settings, dining hall and class (figure). No baseline data were available so training effects cannot be fully evaluated. The form What (that)? (doing)? was never observed. K.O.'s generalization data are presented in Figures 17-18.

Complexity Effects

MLU decreased from 1.55 to 1.3 over time. Verbs per utterance dropped from nearly .5 to .25. The decrease in verbs was probably a major factor in the decrease in MLU. Other complexity measures showed very little change. The mean number of nominals, verbs, modifiers, and function words per observation increased slightly.

Rate Effects

No rate data were taken on this subject.

Summary

One of the two trained forms was observed in two settings but a lack of baseline data makes it impossible to determine whether this was a direct result of training. Overall language development was minimal. Linguistic complexity decreased, especially the number of verbs per utterance.

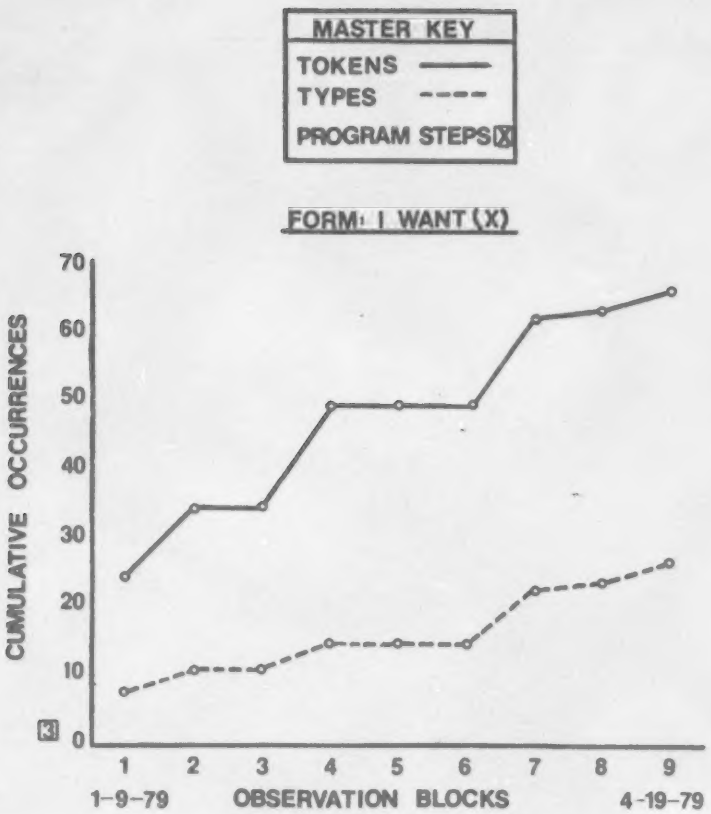
Subject: B.H. Sex: Male Age: 11.3 to 12.7

Training

B.H. entered KNI in September, 1973. Training on the Guess, Sailor, Baer program began in March, 1978, with step 1, and progressed to step 7.

SUBJECT; KO SITE; KNI

FORMS; COMBINED SETTINGS



NO OCCURRENCES FOR THE FOLLOWING FORM:

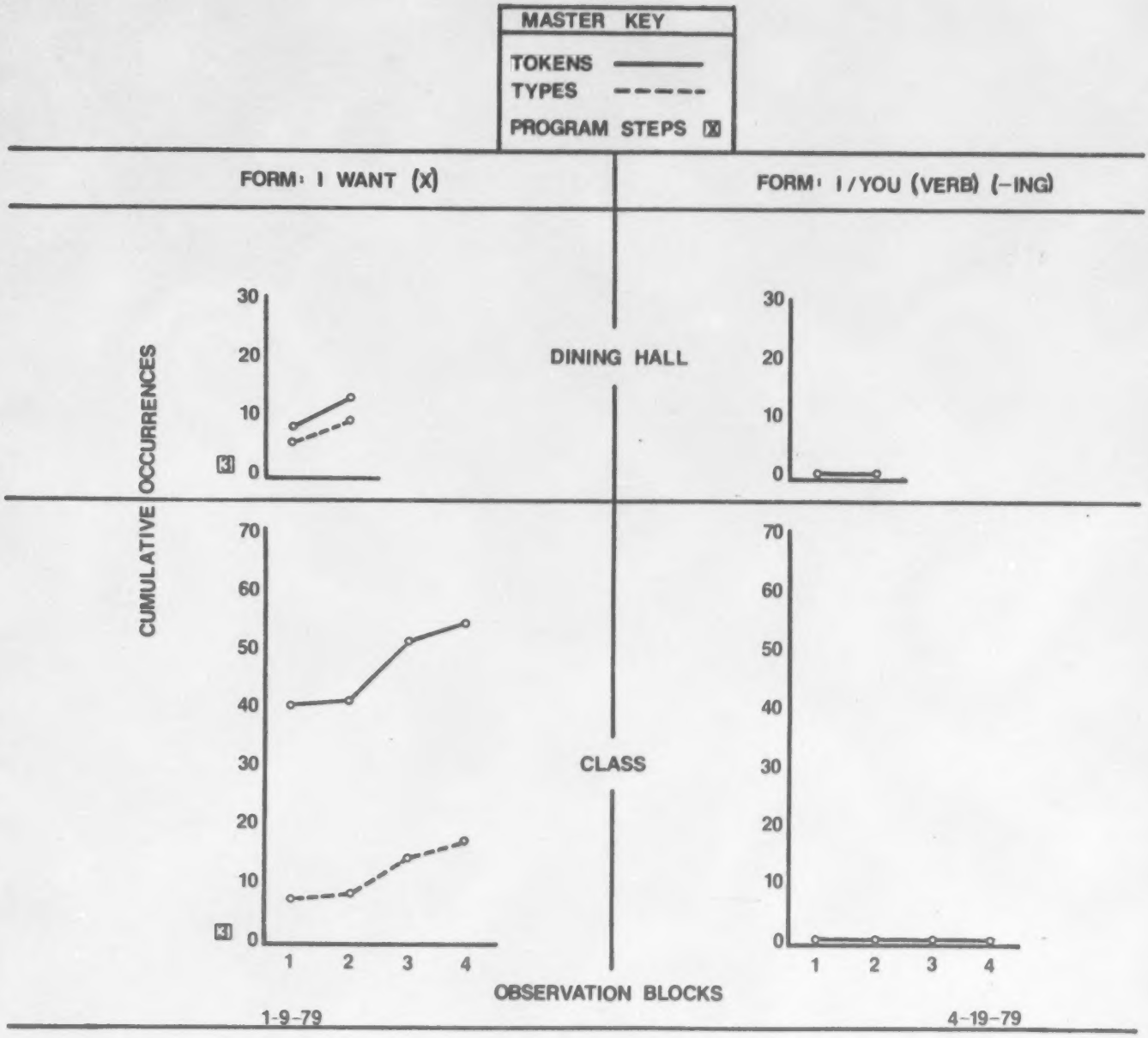
1) WHAT (THAT)? (DOING)?

Figure 17

Figure 18

SUBJECT; KO **SITE; KNI**

FORMS; BY SETTING



steps 3, 5, 6, and 7 were trained, but criterion was never attained.

Assessments

The results of the PPVT, STACL and Houston (Part I) were displayed below.

	PPVT	STACL	Houston
October 1978	M.A. 1-9	Unscorable	17 mo. level
July 1979	M.A. 1-9	Unscorable	-----
August 1979	----	----	20 mo. level

Word Generalization

B.H. was observed 52 times from April, 1978, to September, 1978; class--24; living unit--14; dining hall--14. The Word generalization ratios were: one occasion, 5/17 (.29); two occasions, 2/17 (.12); two settings, 2/17 (.12). B.H.'s vocabulary included 34 words at the end of the analysis.

Structure Generalization

Two forms were trained: I want X and What (that)? (doing)?. "I want "X" generalized to the settings, class and dining hall. Most of the occurrences were in class near the end of training on step 3 and soon after. "What (that)? (doing)?" occurred once during training in the class setting. There were no occurrences of either form in the living unit. B.H.'s structure generalization is shown in Figures 19-20.

Complexity Effects

MLU was variable and never above 2.0 with a slightly decreasing trend. Upperbound ranged from three to six morphemes, also decreasing a little over time. B.H.'s utterances consisted mainly of nominals. Other complexity data showed low and variable rates. The mean rates of nominals, verbs, modifiers, and function words were very low and showed no increasing trends.

Rate Effects

No rate data are available.

Summary

B.H. had an extremely low verbalization rate. The complexity of his language did increase. Brief effects of training were observed in the class setting for the form "I want X" although more occurrences were observed later in the follow-up data in both class and dining hall.

Figure 19

SUBJECT: BH

FORMS: SETTINGS COMBINED

SITE: KNI

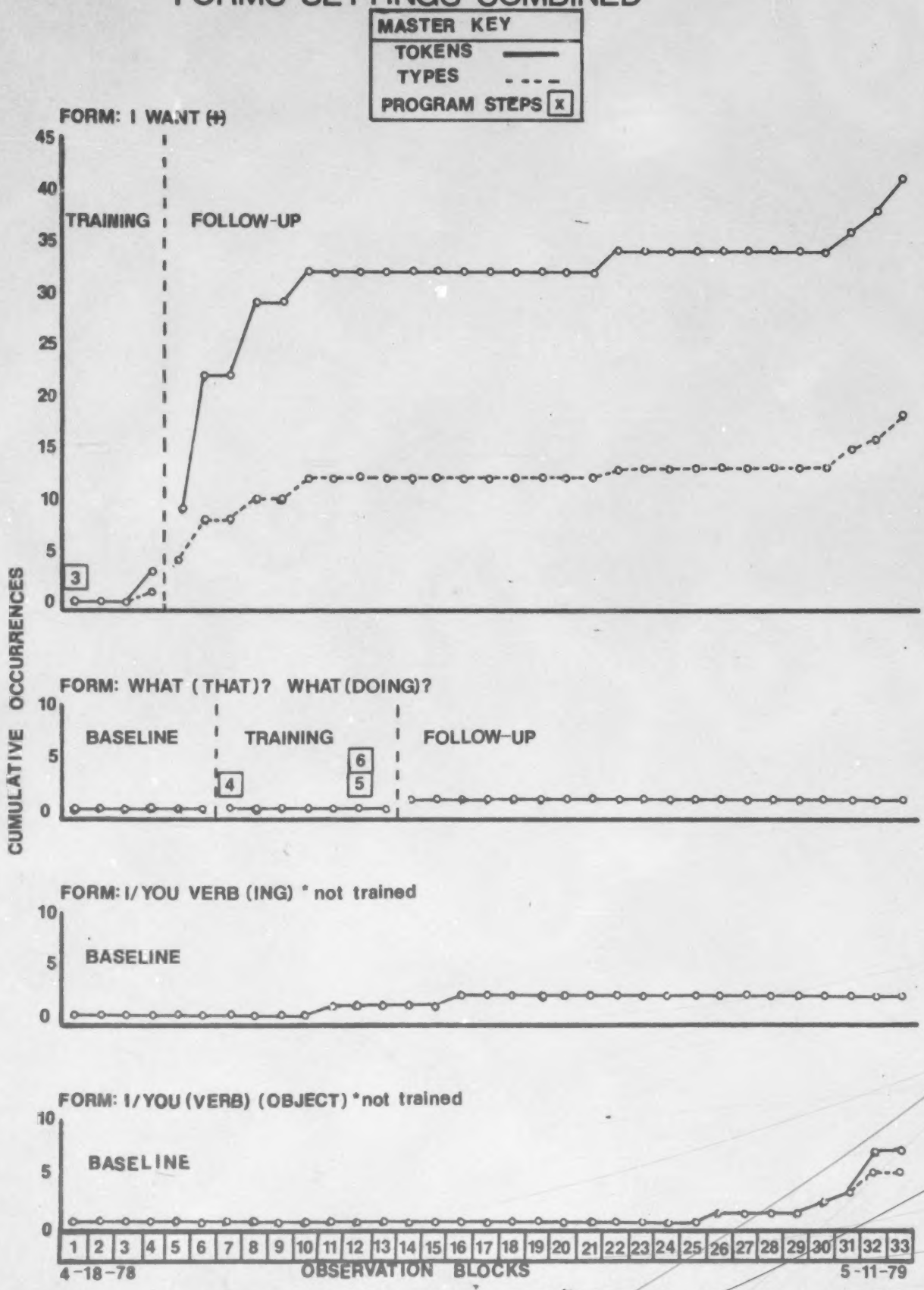
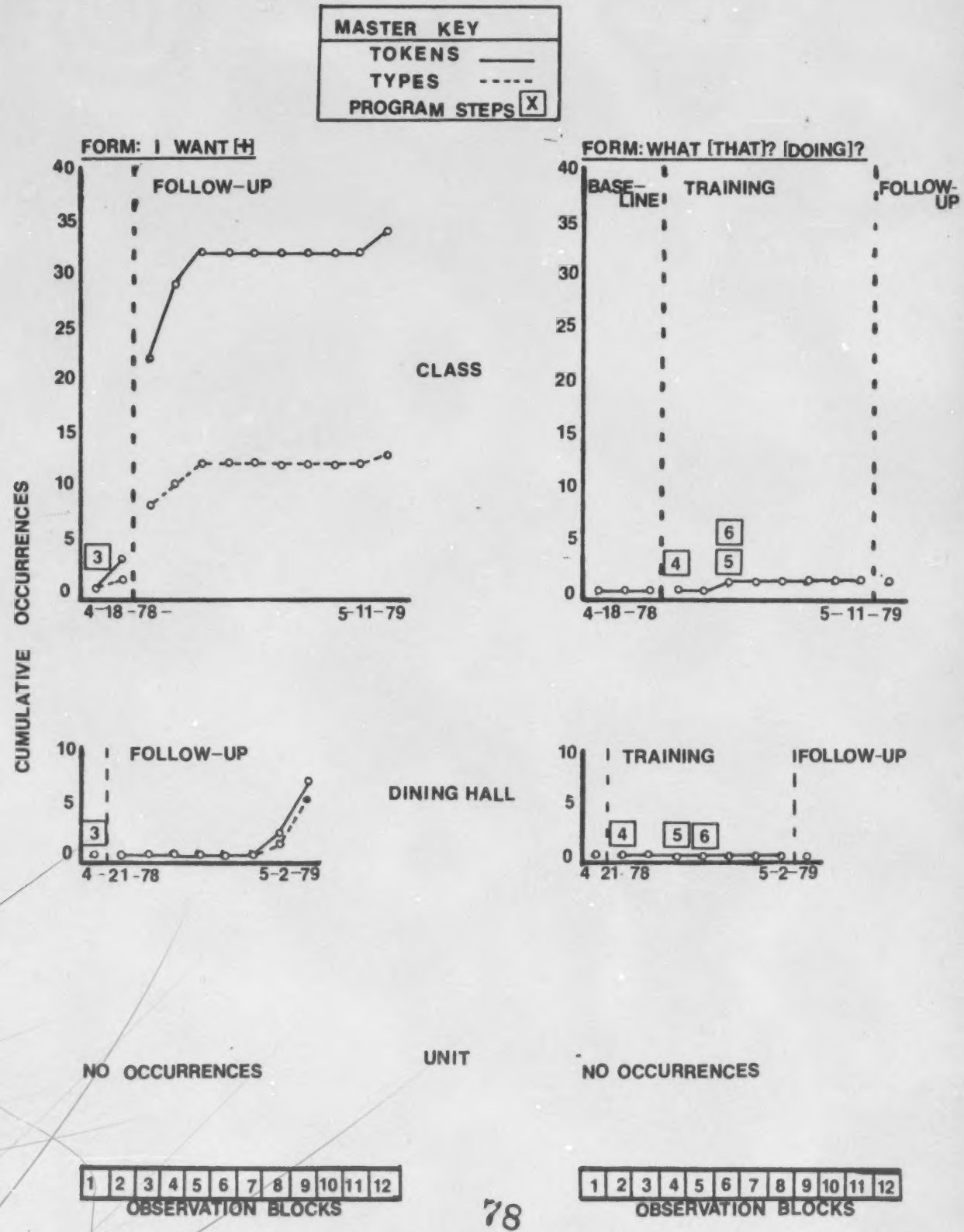


Figure 20

SUBJECT: BH

SITE: KNI

FORMS: BY SETTING



Subject: W.W. Sex: Male Age: 13.2 to 14.4

Training

W.W. was admitted to KNI in July, 1970. He was trained (Stremel & Waryas program) on 23 nouns, 12 verbs, and 11 adjectives from March, 1978, to August, 1978. W.W. was then transferred to the Guess, Sailor and Baer program. Training began in September, 1978, with step 8 and progressed to step 15. W.W. reached criterion on all steps except steps 9 and 15.

Assessments

No assessment data were available.

Word Generalization

W.W. was observed 44 times from January through May of 1979; class--14; living unit--16; dining hall--14. The word generalization ratios were:

	One Occasion	Two Occasions	Two Settings
Nouns	3/23 (.13)	1/23 (.04)	0/23 (0)
Verbs	4/12 (.33)	2/12 (.08)	1/12 (.08)
Adjectives	1/11 (.09)	0/11 (0)	0/11 (0)
TOTAL	8/56 (.14)	2/56 (.04)	1/56 (.02)

W.W.'s vocabulary included 167 words.

Structure Generalization

Data were limited but generalization occurred for the forms I/You Verb(ing) and I/You Verb Object in the living unit setting (see Figures 21-23). Three forms occurred in all settings. "What (that) (doing)?" occurred in class three times in one observation.

Complexity Effects

MLU was variable (range: 1.85 to 3.14) with no trend. Upperbound was also variable with no clear trend (range: four to eight morphemes). Data for other complexity measures followed the same pattern. Nominals per observation was variable but increased over time.

Rate Effects

No rate data were available.

SUBJECT: WW

SITE: KNI

FORMS: COMBINED SETTINGS

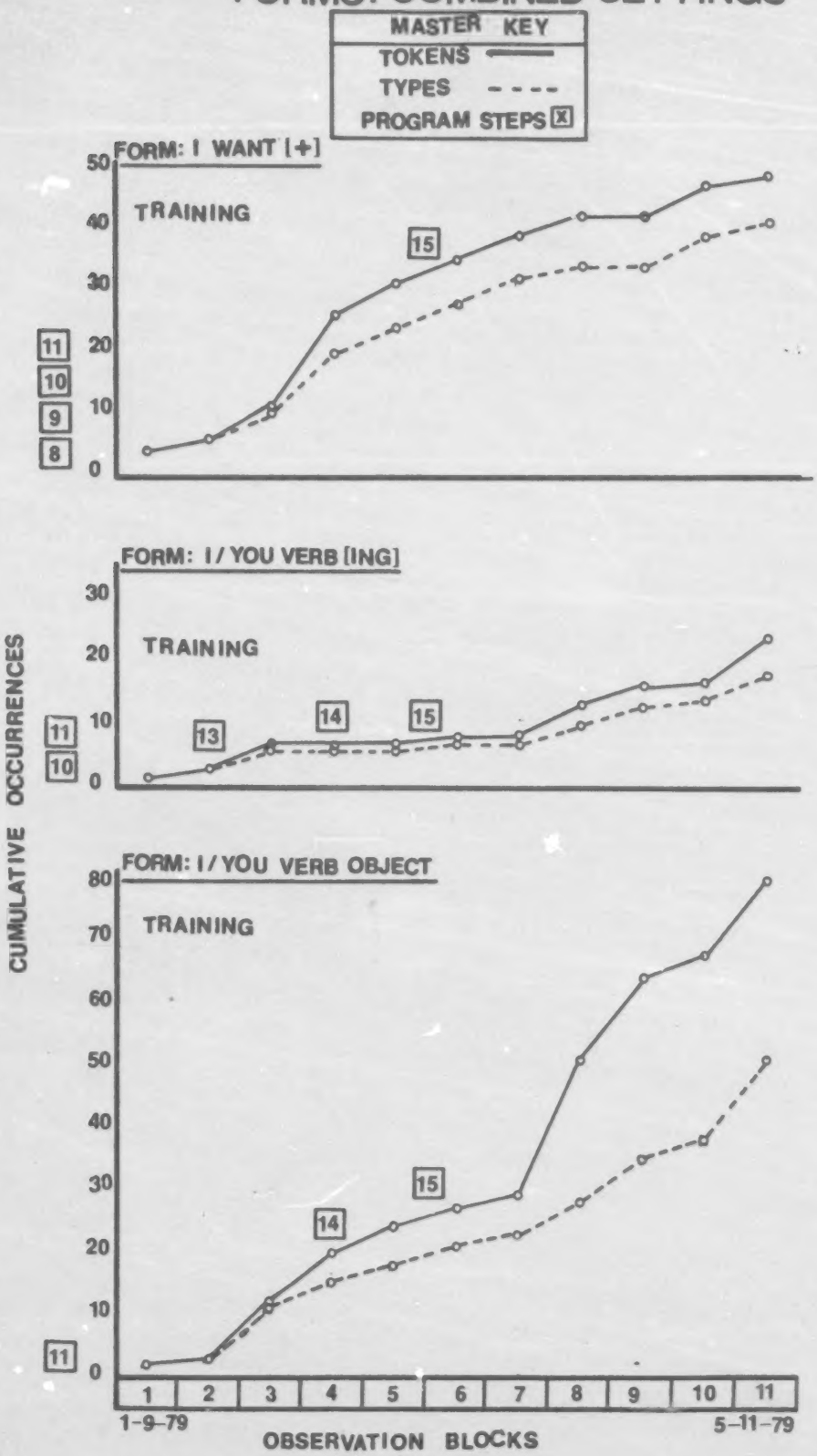
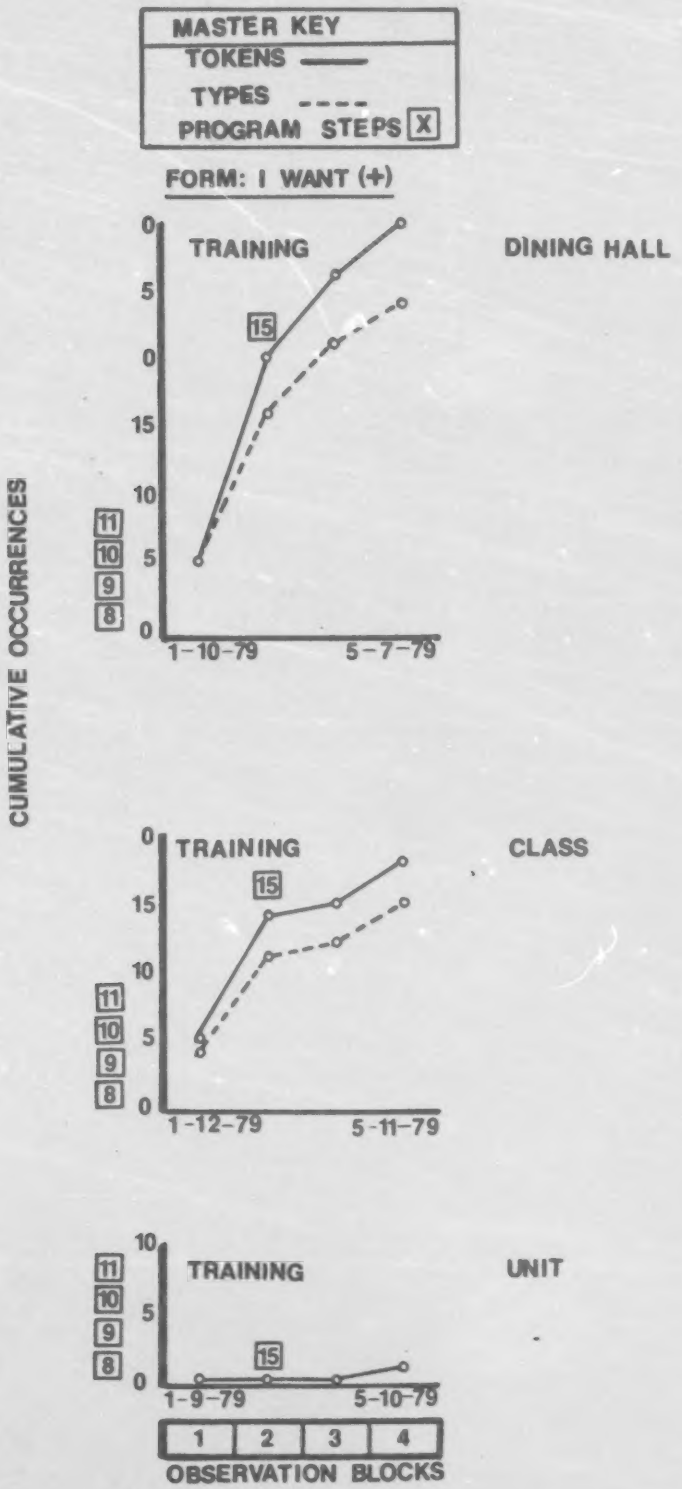


Figure 21

Figure 22

SUBJECT: WW SITE: KNI

FORMS: BY SETTING



SUBJECT: WW

SITE: KNI

FORMS BY SETTING

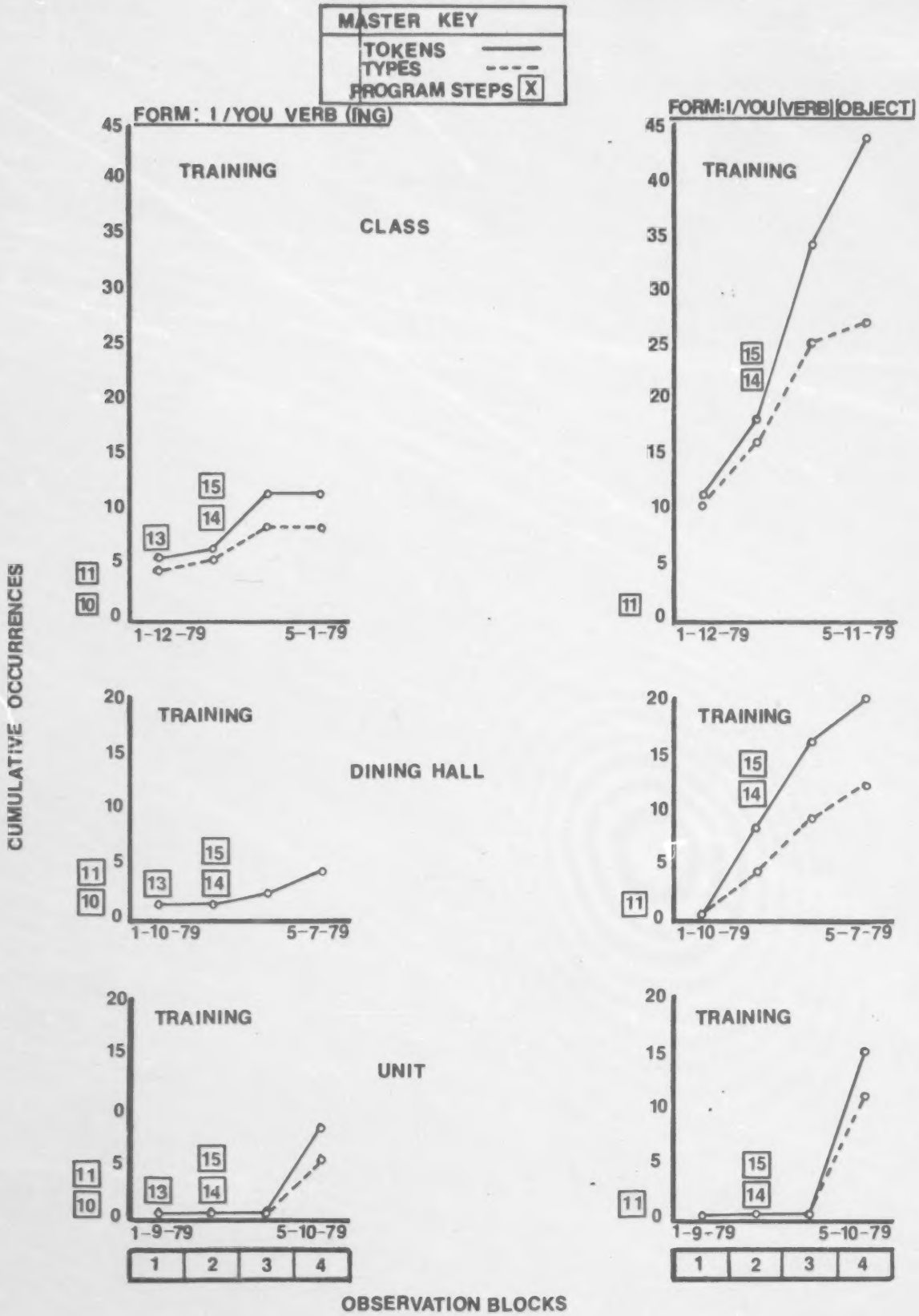


Figure 23

Summary

Data revealed variability but little improvement in W.W.'s performance over the relatively brief period of observation. The forms I/You Verb(ing) and I/You Verb Object appear to have generalized to the living unit setting.

Subject: K.M. Sex: Male Age: 19.5 to 20.0

Training

K.M. was admitted to KNI in July, 1972. Training on the Stremel-Waryas program began with 15 verbs in February, 1978. He was then trained on Verb-Noun combinations (3-6-78 to 11-17-78; 6 exemplars). Shortly after training began on Pronoun-Verb in November, 1978, K.M. was transferred to another institution.

Assessments

The results of the PPVT, STACL and Houston (Part I) are listed below.

	PPVT	STACL	Houston
October 1978	M.A. 4-8	Unscorable	36 mo. level

Word Generalization

K.M. was observed 114 times from November, 1977, through September, 1978; class--32; living unit--29; dining hall--34; art class--17. The word generalization ratios were: one occasion, 8/15 = .53; two occasions, 6/15 = .40; two settings, 6/15 = .40. K.M.'s vocabulary included 443 words.

Structure Generalization

Occurrences of the collapsed form Nominal-Verb/Verb-Nominal are presented in Figures 24-25. Clear training effects occurred in the living unit setting. There were many baseline occurrences in the class setting. A lack of adequate baseline data for the other settings precludes the interpretation of training effects. The baseline occurrences accelerated during verb training.

Complexity Effects

MLU was below 2.0 before training began. Immediately after training started MLU became extremely variable. But it became less variable over time. At the end of the observational period it was 2.35. Upperbound was less variable over time also. At the end of the

Figure 24

SUBJECT: KM

SITE: KNI

COLLAPSED FORMS:
SETTINGS COMBINED

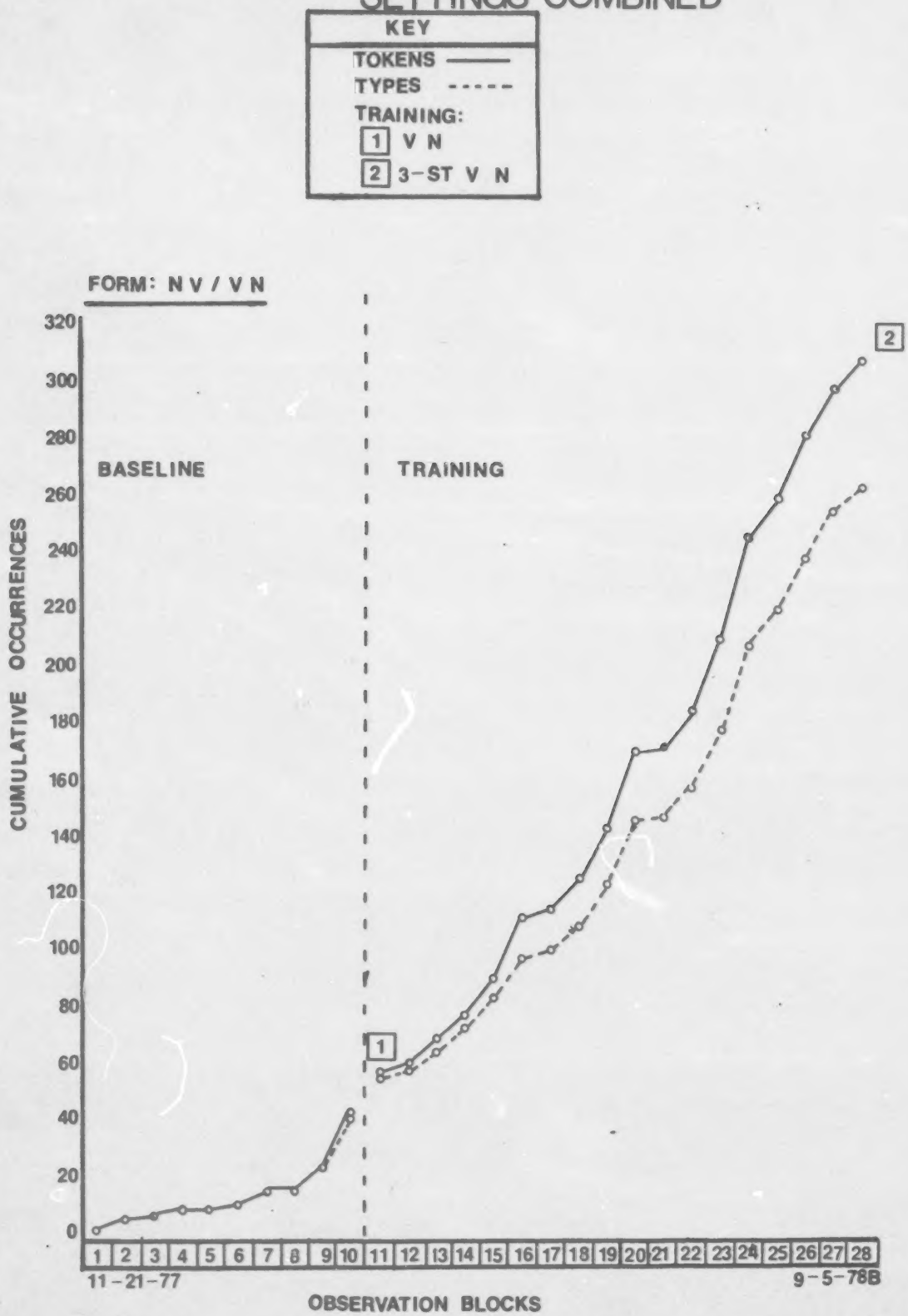
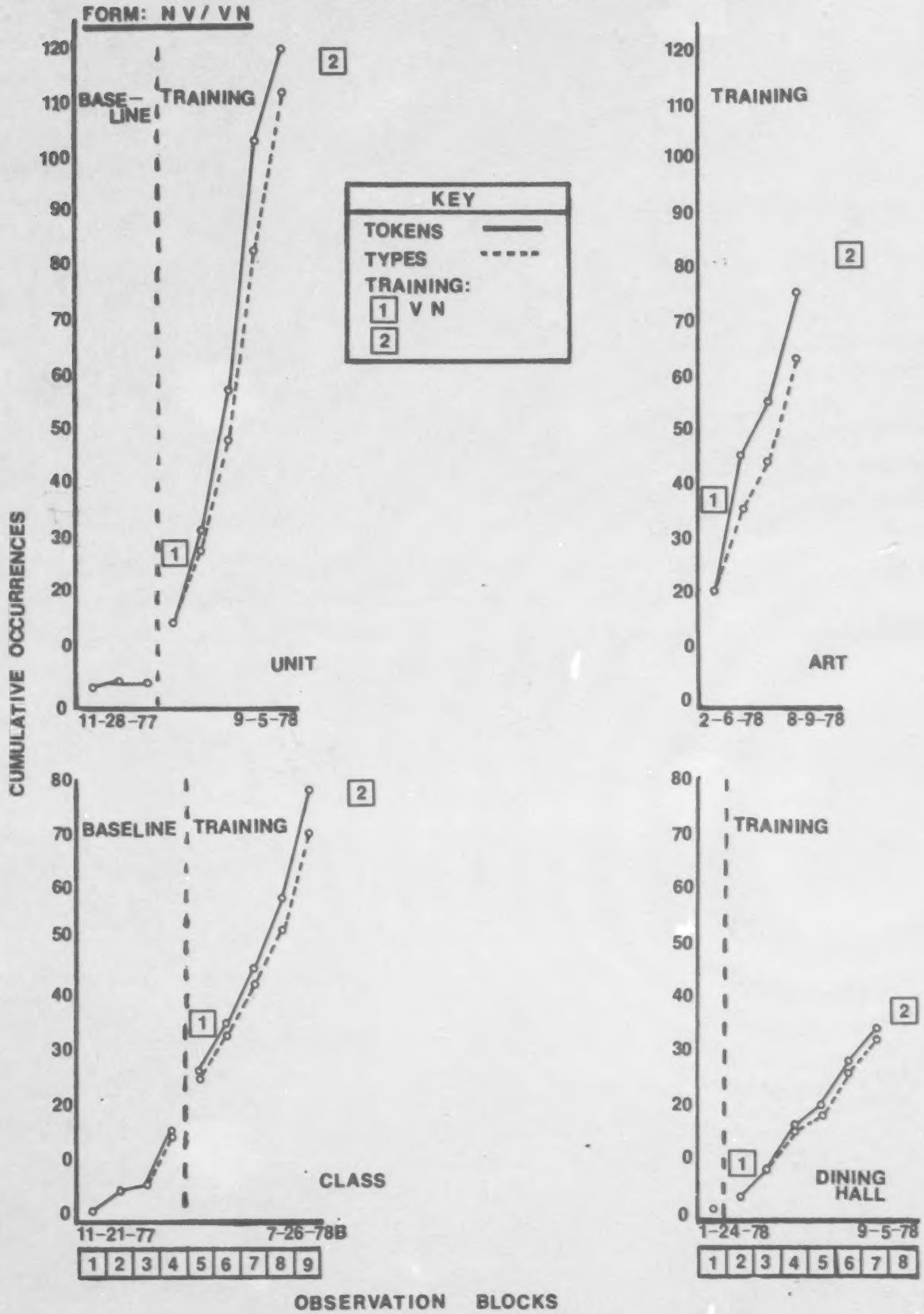


Figure 25

SUBJECT: KM SITE: KNI

COLLAPSED FORMS: BY SETTINGS



observational period it was 6.0 morphemes (range: 3 to 11 morphemes). No increasing trend was observed. Other complexity measures followed a similar pattern showing large increases immediately after training began, then more variability, which decreased over time. The final measures were higher than the original baseline measurements.

Rate Code Effects

Forty rate code observations were taken from January to May, 1978; class--10; dining hall--15; living unit--5; art class--10. K.M.'s mean initiation rate was similar in all settings (10 utterances). His total verbalization rate was much lower in dining hall than other settings, where high rates occurred. The mean percentage of obligatories situations responded to was high in the class setting (70% to 80%). The rates of teacher verbalizations to K.M. were high in all settings.

Summary

Training effects on the form Nominal-Verb/Verb-Nominal occurred when training on specific verbs was initiated. Overall language performance became quite variable when training began. This variability decreased over time revealing slight increases in complexity, rate and diversity over baseline data.

Subject: S.I. Sex: Female Age: 20.8 to 22.4

Training

S.I. was admitted to KNI in April, 1962. Training on the Guess, Sailor and Baer program began in March, 1978, with step 3 and progressed to step 15. Criterion was reached on all steps except steps 5, 6, 9, 12, and 15.

Assessments

The results of the PPVT, STACL and Houston (Part I) are listed below.

	PPVT	STACL	Houston
September 1978	M.A. 2-3	----	----
October 1978	----	Unscorable	31 mo. level
July 1979	M.A. 2-11	Unscorable	----
August 1979	----	----	29 mo. level

Word Generalization

(Not applicable) S.I.'s vocabulary included 278 words.

Structure Generalization

S.I. was observed 223 times from November, 1977, through May, 1979; class--63; living unit--66; dining hall--61; art class--33. Only two of the four trained forms occurred: I want X and What (that)? (doing)? There were a few occurrences of "I want X" during training of unrelated steps, but slackened during training on relevant steps, and recovered when training on those steps was completed. During this recovery, increases were also observed in the living unit and dining hall settings. "What (that) (doing)?" occured once in class during training in step 4. S.I.'s structure generalization data are presented in Figures 26-29.

Complexity Effects

MLU was variable with no trend and ranged from 1.11 to 2.55. Upperbound was also variable with no trend and ranged from 2 to 7 morphemes. Other complexity measures followed the same pattern. Utterances consisted mainly of nominals. The mean rates of nominals, verbs, modifiers and function words per observation were very low.

Rate Effects

Forty-four rate observations were taken from January, 1978, through May, 1978; class--15; dining hall--13; living unit--5; art class--11. All rate measures except initiations were much higher in the class setting than in other settings. The mean percentage of obligatories answered was 70% in class and lower than 40% in other settings.

Summary

S.I.'s overall linguistic performance did not improve over the observational period, however, possible generalization of training occurred for the form "I want X" in all settings except art class.

Subject: T.G. Sex: Female Age: 8.10 to 10.9

Training

T.G. entered KNI in January, 1975. Training on the Guess, Sailor and Baer program began with step 2 and rapidly progressed to step 24. She tested out of six steps. Criterion was reached on all other steps. Twenty-six nouns and four pronouns were specifically trained. The mean time spent training each step was 2.4 sessions.

Figure 26

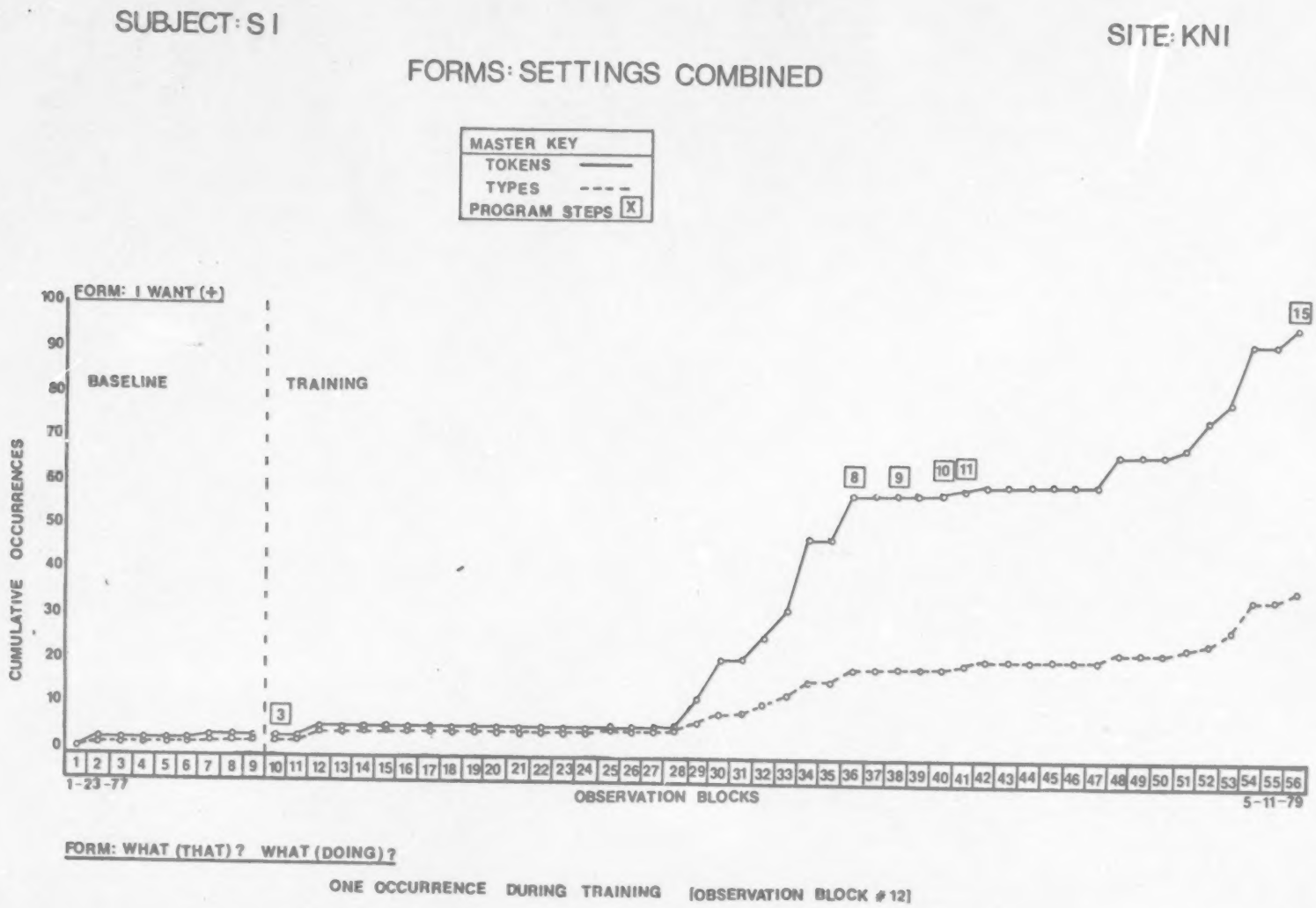

SUBJECT: S I
SITE: KNI
FORMS: SETTINGS COMBINED
MASTER KEY
TOKENS
TYPES
PROGRAM STEPS X
FORM: I WANT (+)
BASELINE
TRAINING
CUMULATIVE OCCURRENCES
100
90
80
70
60
50
40
30
20
10
0
3
8
9
10
11
15
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56
1-23-77
OBSERVATION BLOCKS
5-11-79
FORM: WHAT (THAT)? WHAT (DOING)?
ONE OCCURRENCE DURING TRAINING (OBSERVATION BLOCK # 12)

Figure 27

SUBJECT: SI

SITE: KNI

FORMS: COMBINED SETTINGS

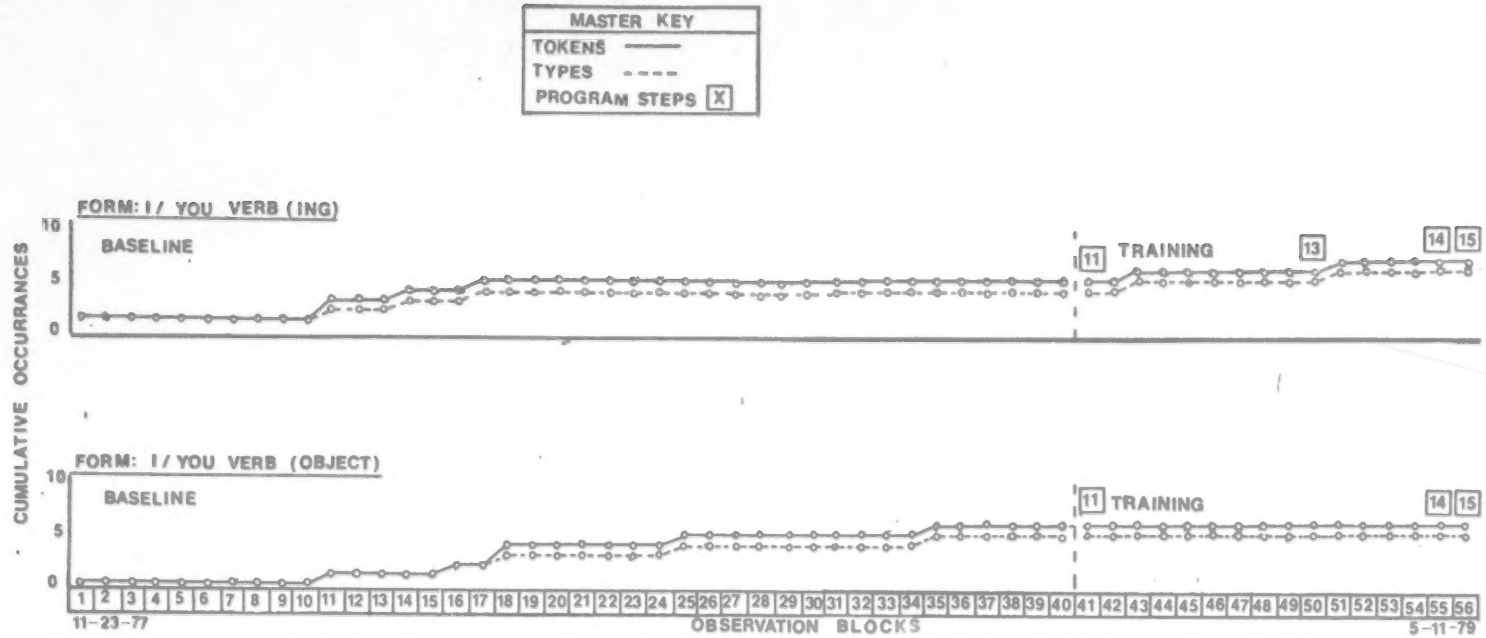

MASTER KEY
TOKENS
TYPES
PROGRAM STEPS X
FORM: I / YOU VERB (ING)
BASELINE
11 TRAINING
13
14 15
FORM: I / YOU VERB (OBJECT)
BASELINE
11 TRAINING
14 15
CUMULATIVE OCCURRANCES
10
5
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56
11-23-77
OBSERVATION BLOCKS
5-11-79

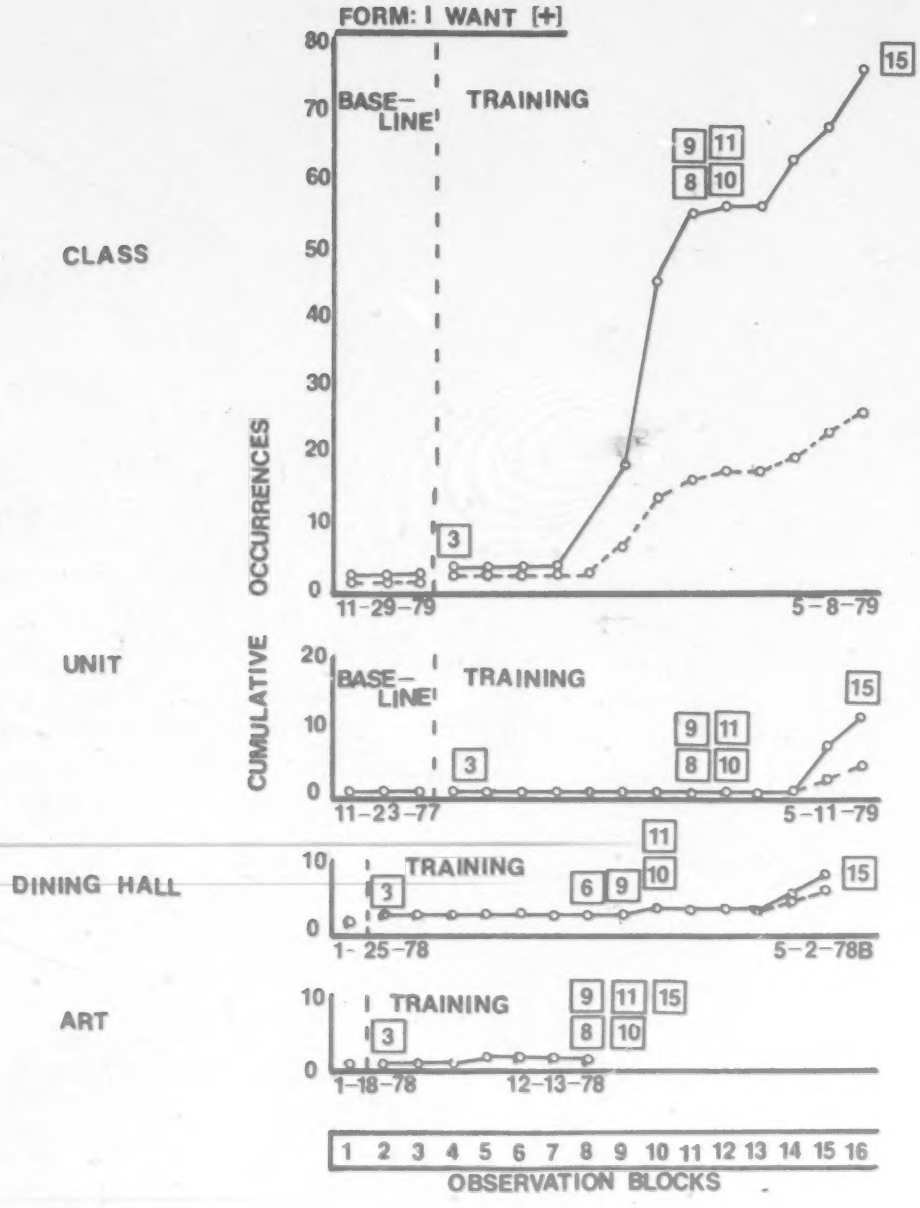
Figure 28

SUBJECT: S1

SITE: KNI

FORMS: BY SETTINGS

MASTER KEY	
TOKENS	———
TYPES	- - - - -
PROGRAM STEPS	X



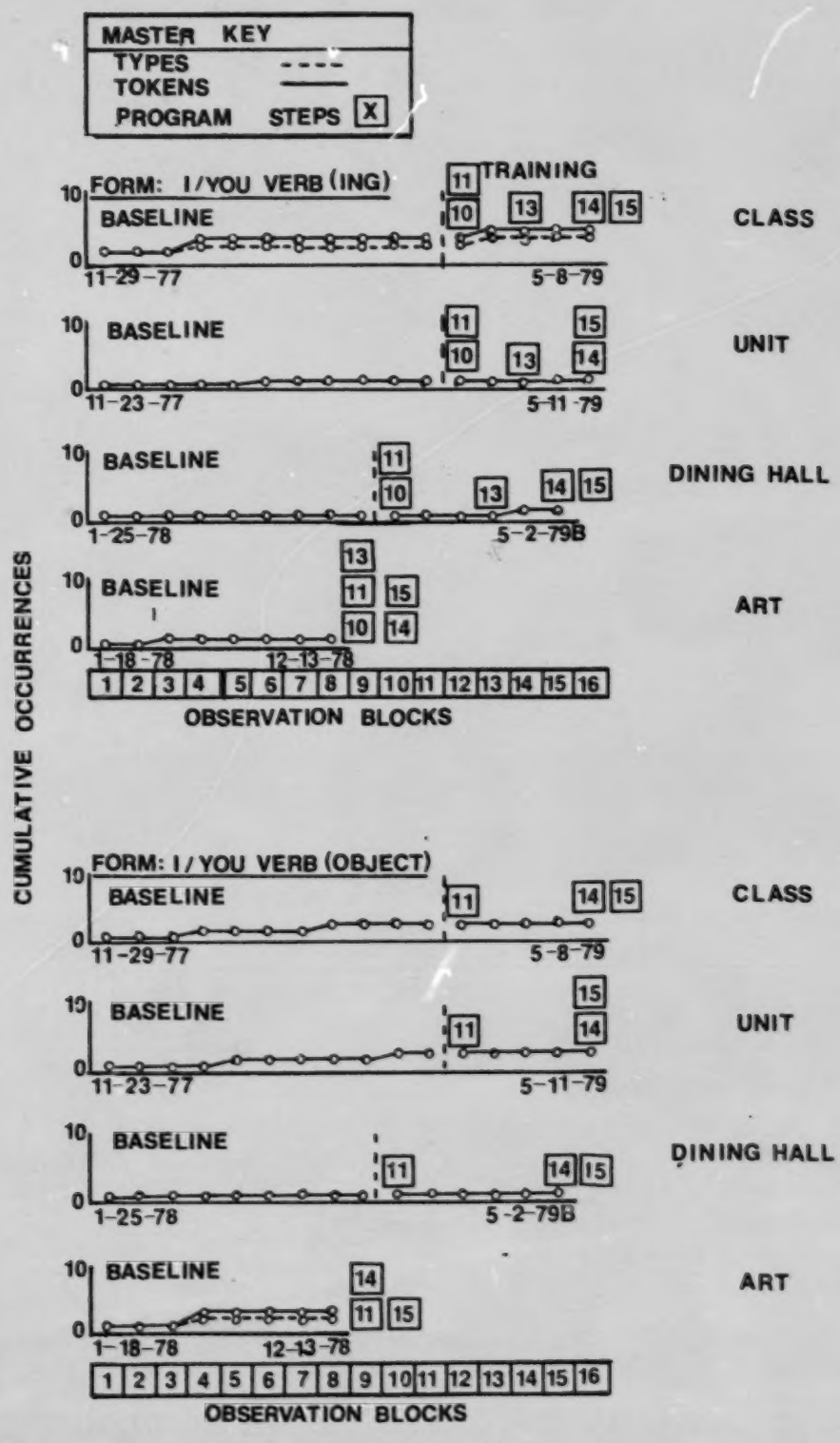
FORM: WHAT [THAT]? WHAT [DOING]?

ONE OCCURRENCE DURING TRAINING [IN CLASS SETTING, BLOCK 4]

Figure 29

SUBJECT: SI SITE: KNI

FORMS: BY SETTINGS



Assessments

The results of the PPVT, STACL and Houston (Part I) are presented below.

	PPVT	STACL	Houston
October 1978	M.A. 3-8	Unscorable	35 mo. level
July 1979	M.A. 3-0	Unscorable	----
August 1979	----	----	36 mo. level

Word Generalization

Word generalization data were derived from 135 observations during the period of September, 1977, to September, 1978; class--43; living unit--40; dining hall--35; art class--17. Word generalization ratios were:

	One Occasion	Two Occasions	Two Settings
Nouns	10/26 = .38	8/26 = .31	8/26 = .31
Pronouns	4/4 =1.00	4/4 =1.00	4/4 =1.00
TOTAL	14/30 = .47	12/30 = .40	12/30 = .40

T.G.'s vocabulary included 593 words.

Structure Generalization

Two hundred and thirty-nine observations were taken from September, 1977, through May, 1979; class--67; dining hall--66; living unit--66; art class--35. The occurrences of the four functional forms are presented in Figures 30-35. No baseline data were available. Training accelerated the use of the following forms in the specified settings:

Forms	Settings
I want X	Class, dining hall
I/You Verb(-ing)	Class, dining hall
I/You Verb Object	Unit, class, dining hall

T.G.'s use of What (that) (doing)? accelerated in all settings near the end of the observational period, but this did not appear to be an effect of training.

Complexity Effects

MLU was variable, with an average of 2.0. Upperbound was also variable (range: four to nine morphemes). Other complexity measures revealed variability with no trends.

Figure 30

SUBJECT: TG

FORMS: COMBINED SETTINGS

SITE: KNI

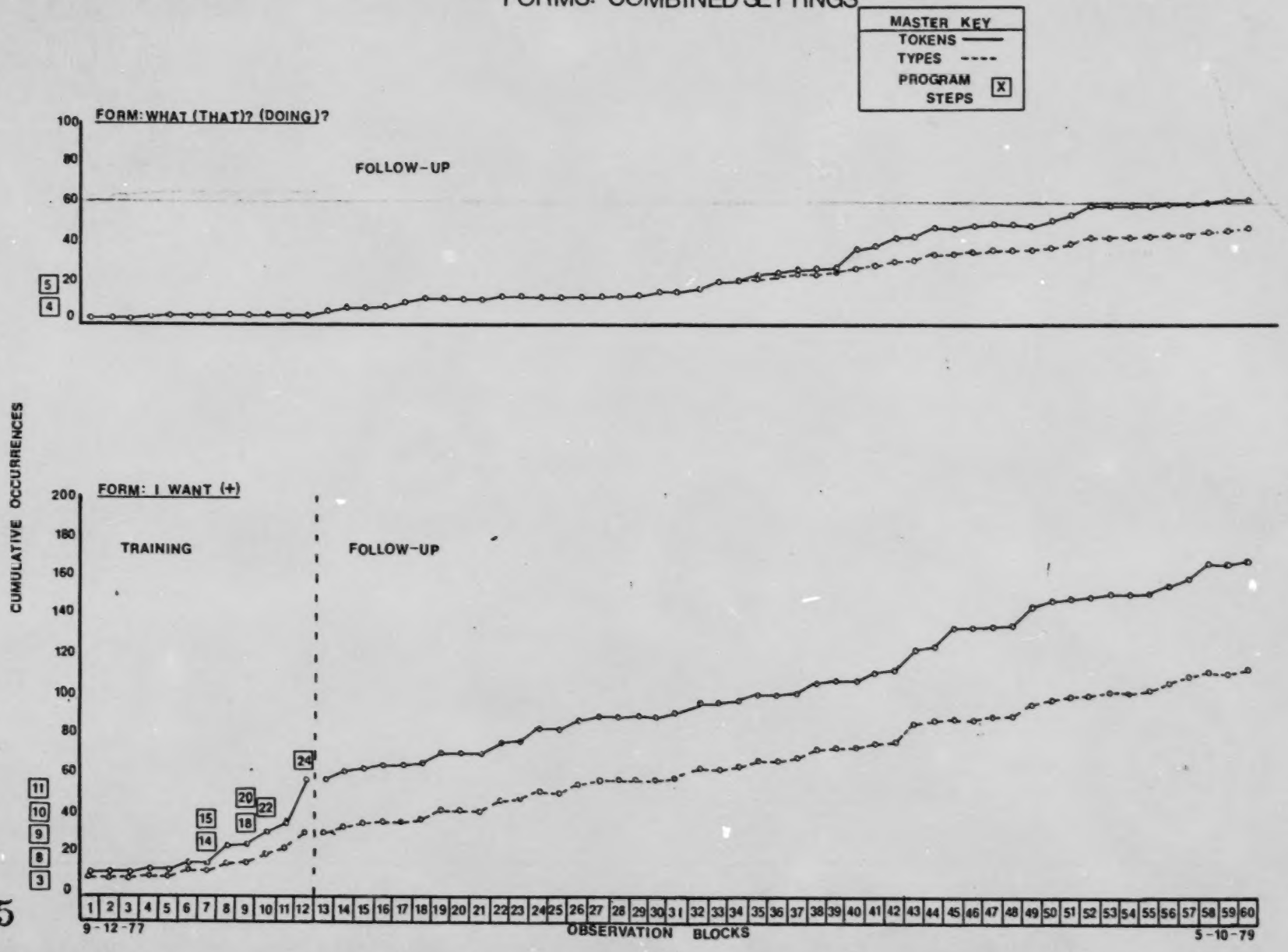
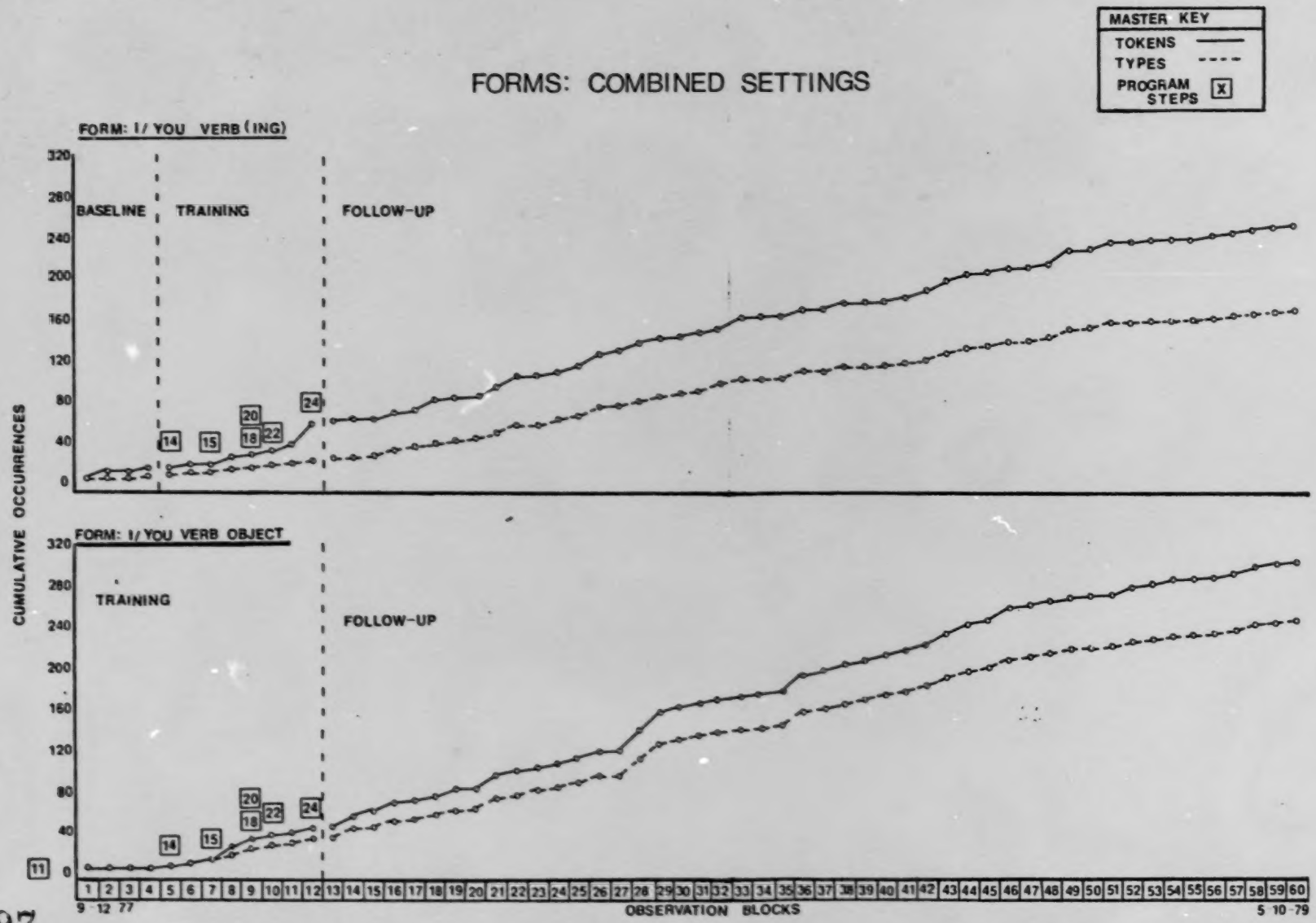


Figure 31

SUBJECT: TG

SITE: KNI

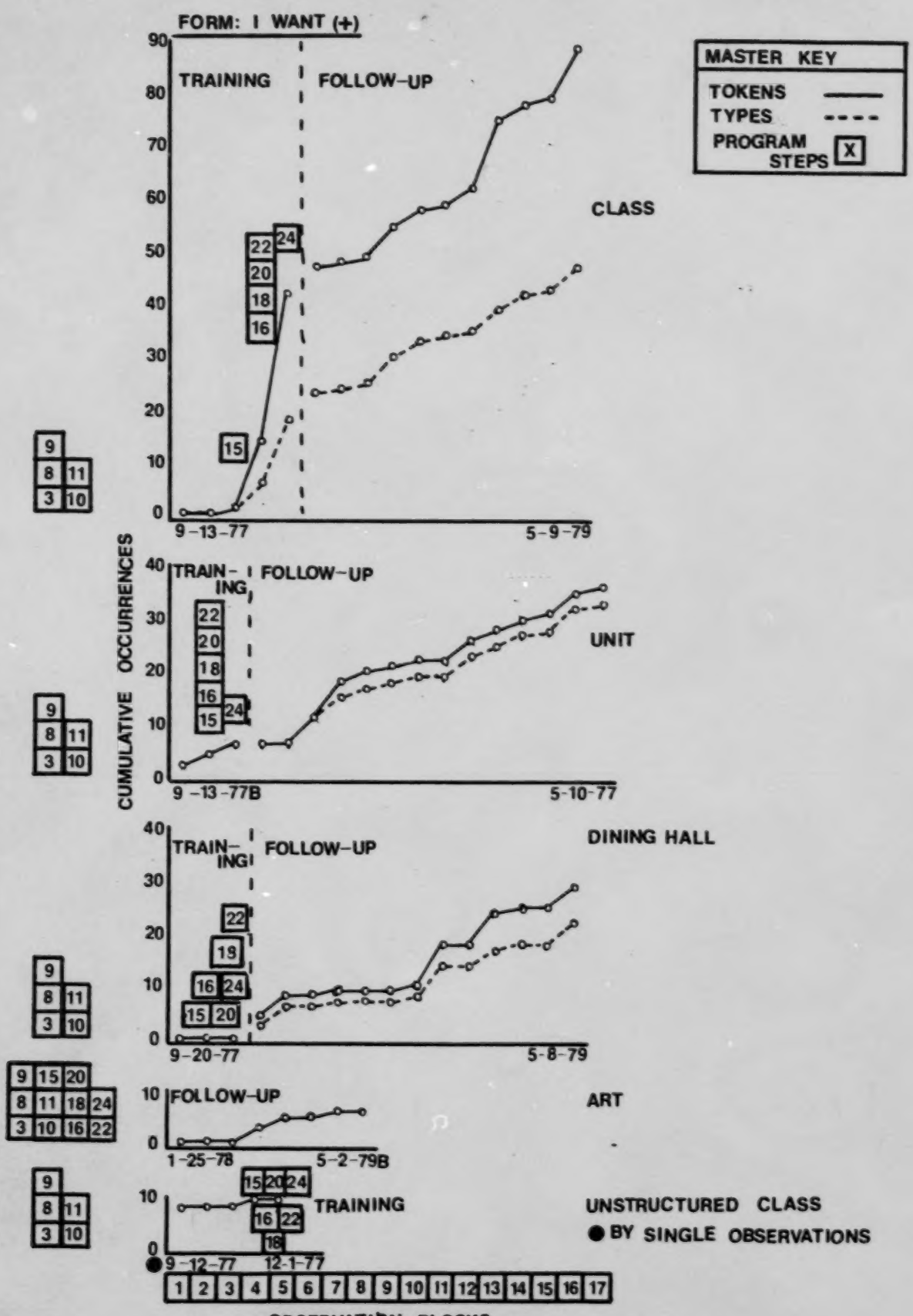


SUBJECT: TG

Figure 32

FORMS: BY SETTING

SITE: KNI



SUBJECT: TG

Figure 33

SITE:KNI

FORMS: BY SETTING

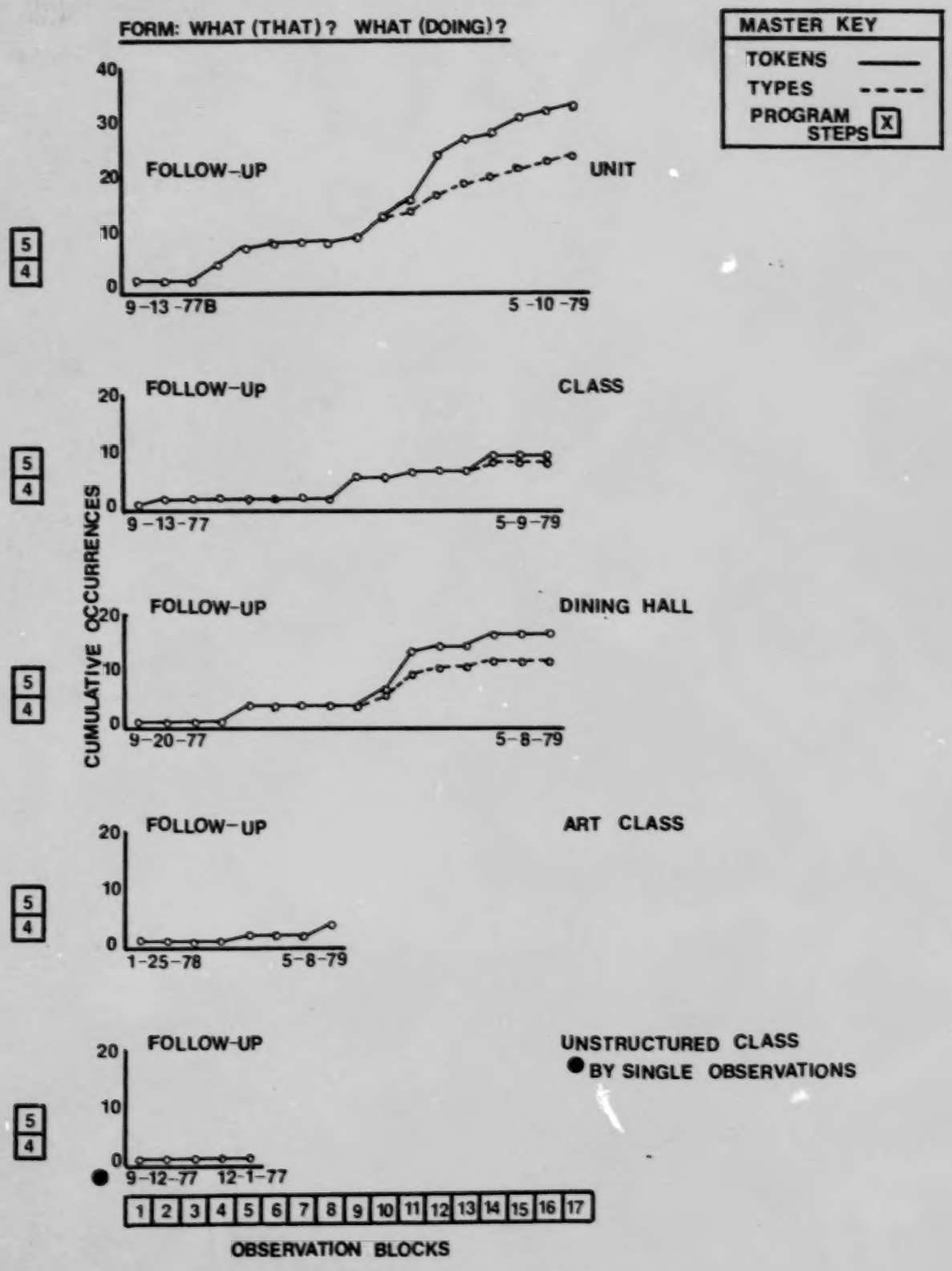


Figure 34

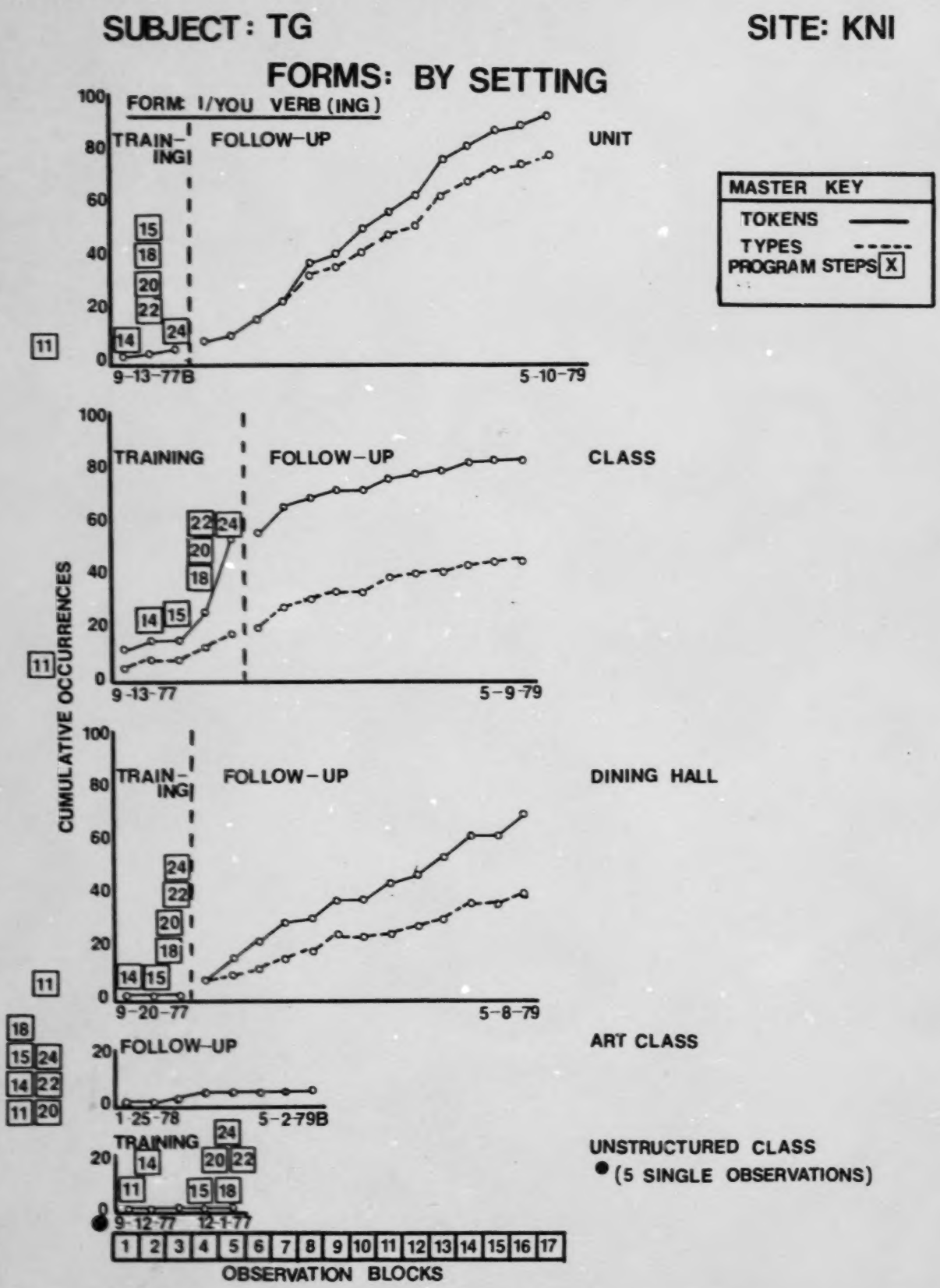
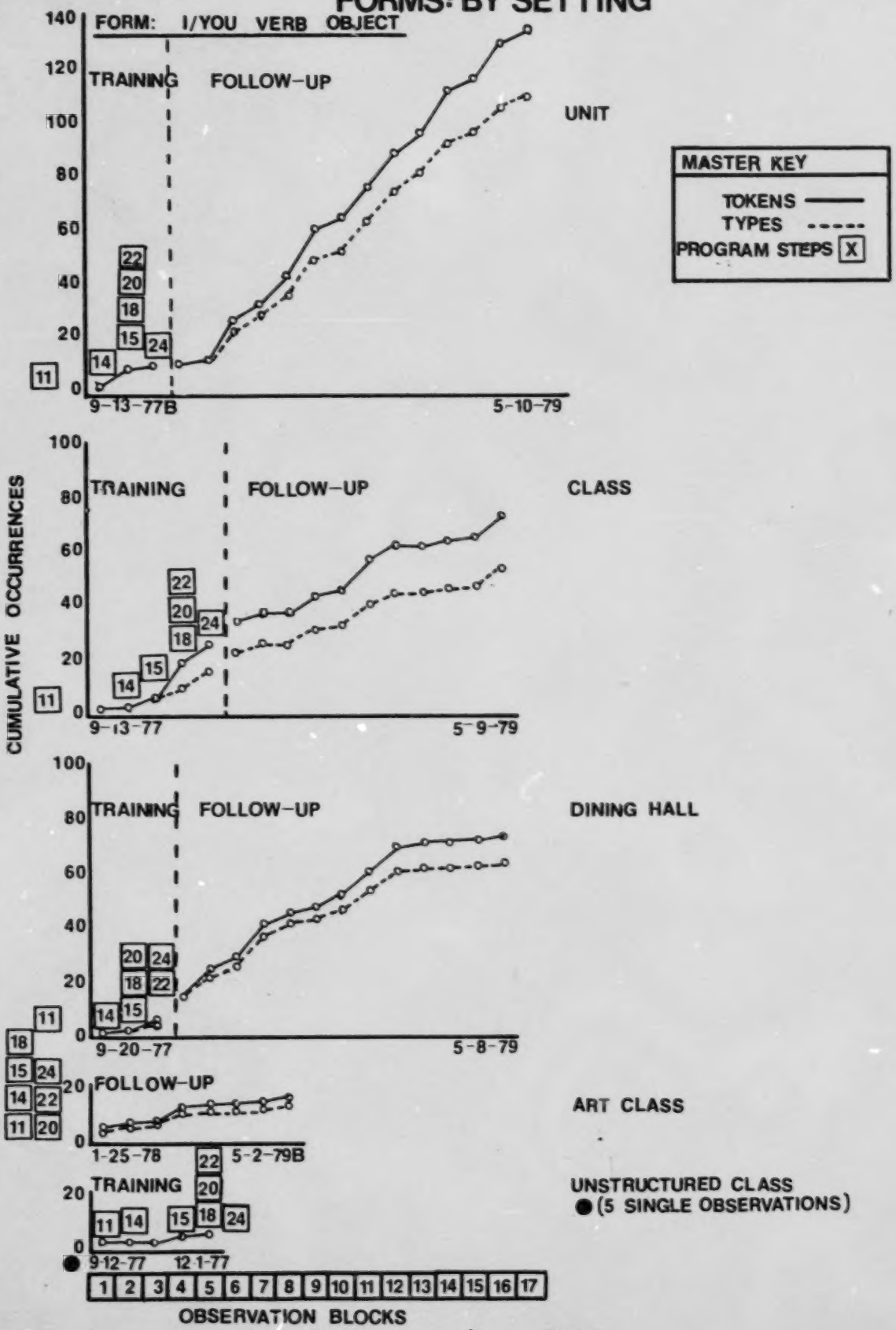

SUBJECT: TG
SITE: KNI
FORMS: BY SETTING
FORM: I/YOU VERB (ING)
TRAIN-ING
FOLLOW-UP
UNIT
MASTER KEY
TOKENS
TYPES
PROGRAM STEPS X
9-13-77B
5-10-79
TRAINING
FOLLOW-UP
CLASS
CUMULATIVE OCCURRENCES
9-13-77
5-9-79
TRAIN-ING
FOLLOW-UP
DINING HALL
9-20-77
5-8-79
FOLLOW-UP
ART CLASS
1-25-78
5-2-79B
TRAINING
UNSTRUCTURED CLASS
● (5 SINGLE OBSERVATIONS)
9-12-77
12-1-77
OBSERVATION BLOCKS

Figure 35

SUBJECT: TG

SITE: KNI

FORMS: BY SETTING



Rate Effects

Thirty-four rate observations were taken from January, 1978, through May, 1978; class--10; dining hall--10; art class--10; living unit--4. Total verbalization rates and initiation rates were high in class, unit, and dining hall. The mean percentage of obligatory situations responded to was above 60% in class and dining hall.

Summary

Training effects were observed for three of the four forms in two settings, class and dining hall. Generalization effects were unclear in the other settings due to the low verbalization rate. There was variability but no trends in overall rate, complexity and diversity of language.

Subject: J.M. Sex: Male Age: 9.4 to 14.2

Training

J.M. was admitted to KNI in June, 1973. Training began with 10 nouns in July of 1974, on the Guess, Sailor and Baer program. Steps 1 through 20 were trained. All steps reached criterion except steps 1, 5, 9, 15, 17, 19 and 20.

Assessments

The results of the PPVT, STACL, and Houston (Part I) are presented below:

	PPVT	STACL	Houston
September 1978	----	----	20 mo. level
October 1978	M.A. 1-11	Unscorable	----
July 1979	M.A. 2-0	Unscorable	----
August 1979	----	----	22 mo. level

Word Generalization

Word generalization data covers 211 observations from September, 1977, to January, 1979; class--64; dining hall--58; living unit--57; art class--32. The word generalization ratios were: one occasion, 4/10 = .40; two occasions, 3/10 = .30; two settings, 3/10 = .30. J.M.'s vocabulary included 422 words.

Structure Generalization

The form "What (that) (doing)?" did not occur. There were consistent baseline occurrences of the other three functional forms. Over time J.M.'s use of two of these three forms decreased (I/You Verb(ing) and I/You Verb Object). No training effects were evident. J.M.'s structure generalization is presented in Figures 36-41.

Complexity Effects

MLU was variable and rose from 2.33 to 2.43 during the second half of the observational period. Upperbound was variable with no trend (range: 4 to 9 morphemes). Other complexity measures were variable with no trend. The mean rates of nominals, verbs modifiers, and function words were generally low and variable.

Rate Effects

J.M. was observed 40 times between January and May of 1978; class--11; dining hall--16; living unit--4; art class--9. Most rate measures were much higher in the class setting. The mean percentage of obligatories answered was 70% in class and less than 30% in other settings. His mean initiation rate was less than 10 utterances in all settings.

Summary

The rate, diversity, and complexity of J.M.'s language showed little change over the observational period. Three of the functional forms occurred extensively in baseline data. The form "What (that) (doing)?" did not occur. No training effects were evident.

KNI Discussion

Longitudinal generalization findings for the KNI subjects are summarized in Table 15 below. The terms Generalized, Acquired, and No Effect are used

---
Insert Table 15 about here
---

to describe the generalization of specific structures. Where the term Generalized appears, the subject used the trained forms in the generalization settings frequently and this appeared to be an outcome of training. Where the term Acquired is used, the subject used the trained form in the generalization setting, but it is unclear what effect training played in this acquisition. Where the term No-Effect is used, the subject either displayed no generalization, or used the form, but clearly not because of training.

Figure 36

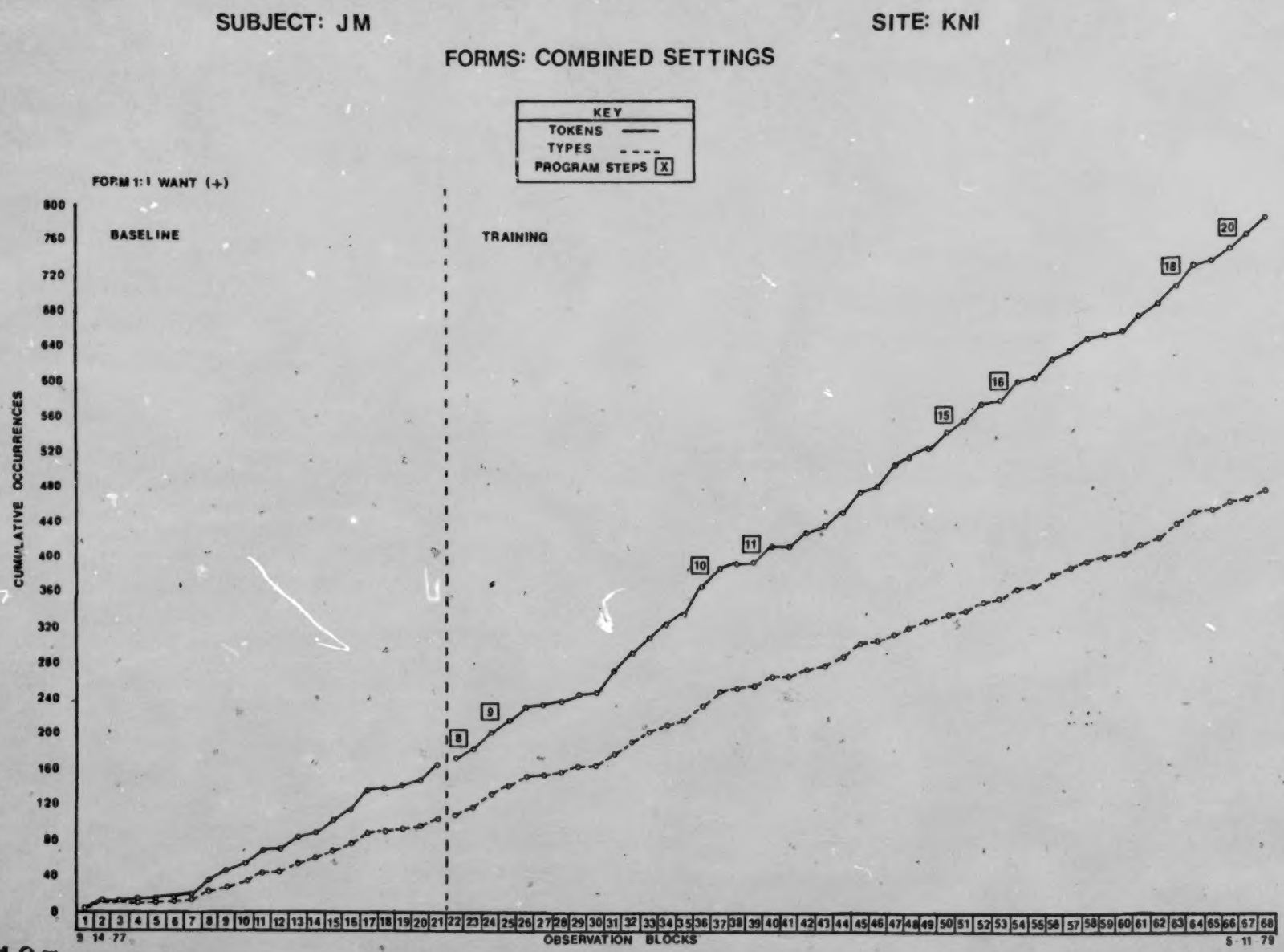

SUBJECT: JM
SITE: KNI
FORMS: COMBINED SETTINGS
KEY
TOKENS
TYPES
PROGRAM STEPS X
FORM 1: I WANT (+)
BASELINE
TRAINING
CUMULATIVE OCCURRENCES
800
760
720
680
640
600
560
520
480
440
400
360
320
280
240
200
160
120
80
40
0
8
9
10
11
15
16
18
20
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68
9 14 77
OBSERVATION BLOCKS
5 11 79

Figure 37

SUBJECT: JM

FORMS: COMBINED SETTINGS

SITE: KNI

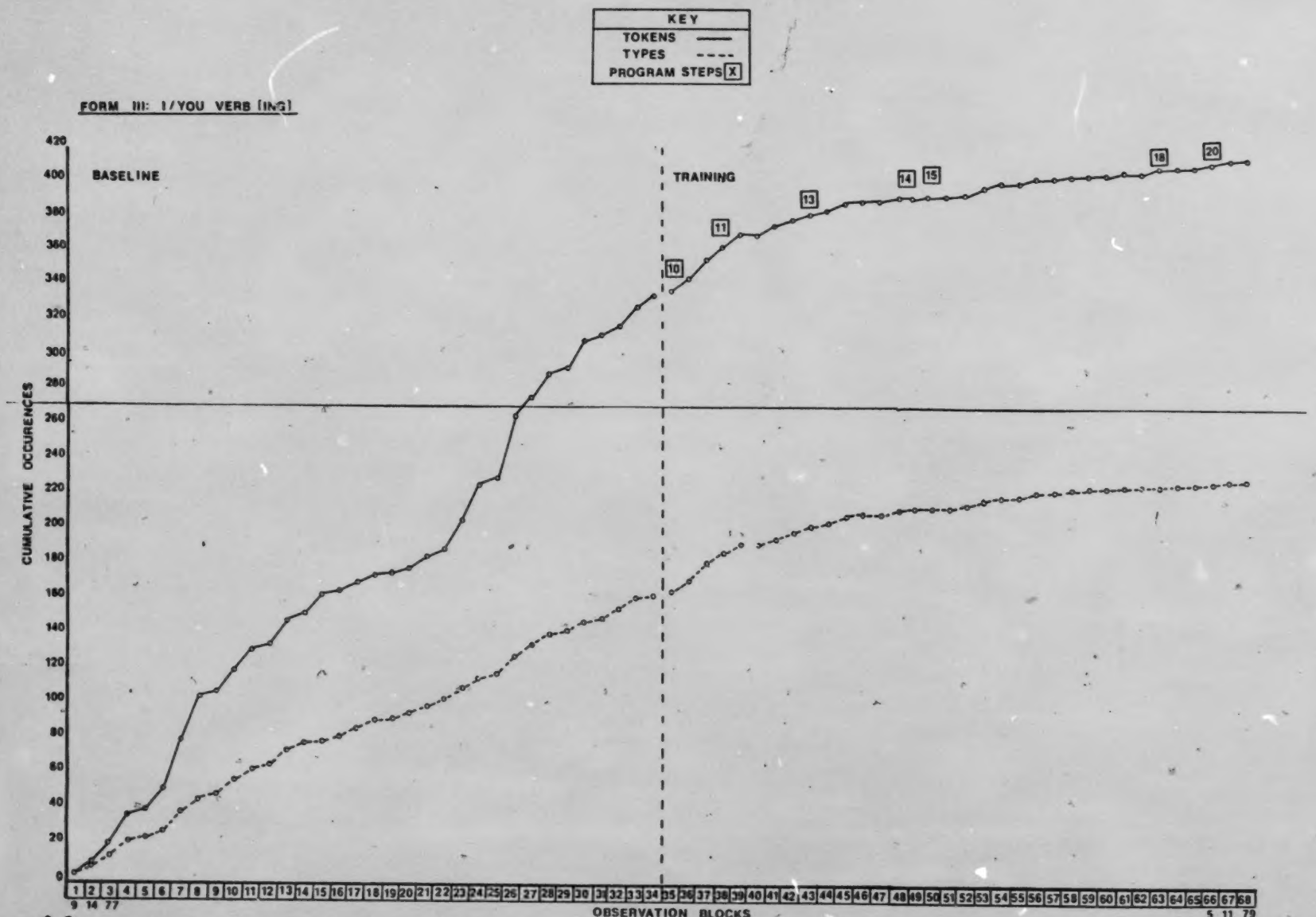


Figure 38

SUBJECT: JM

SITE: KNI

FORMS: COMBINED SETTINGS

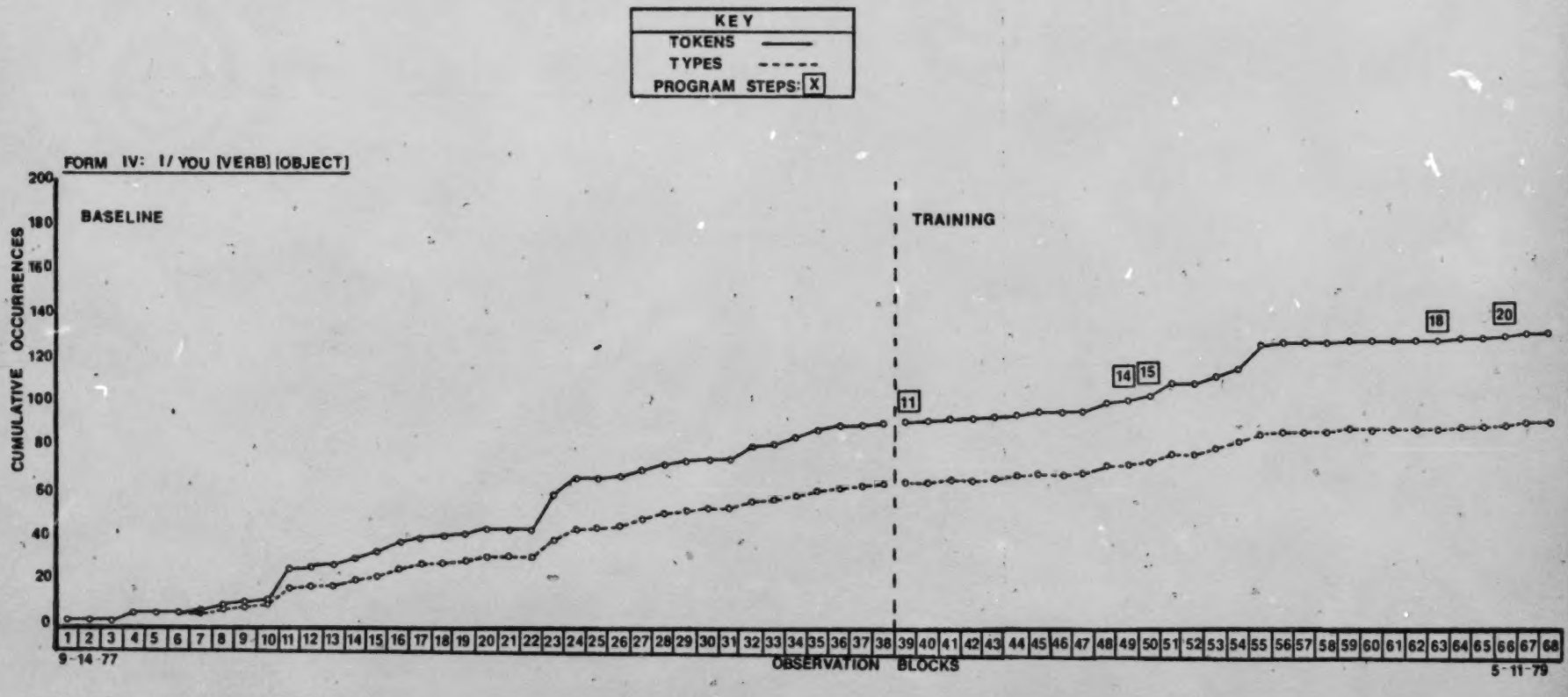


Figure 39

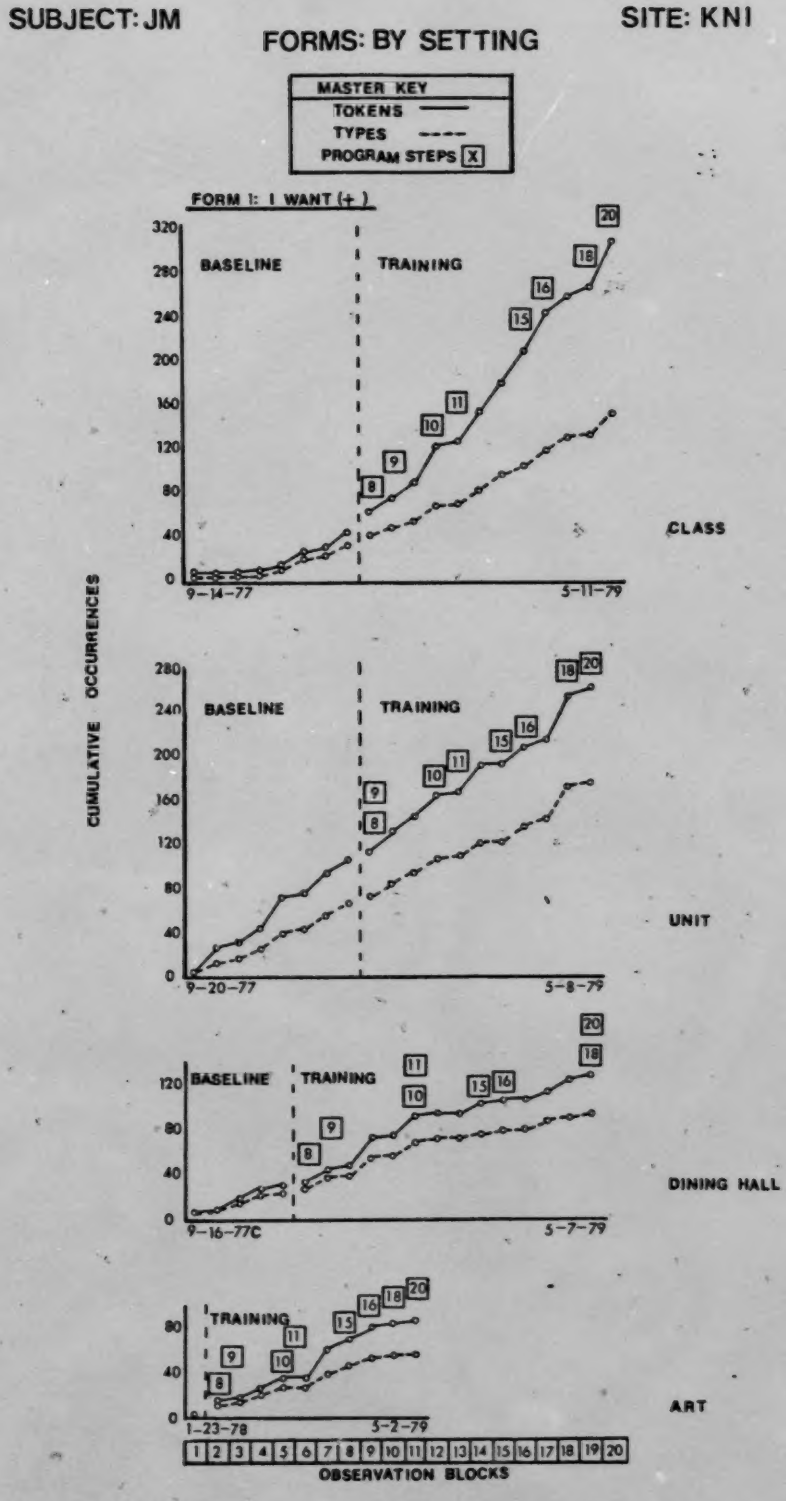

SUBJECT: JM
SITE: KNI
FORMS: BY SETTING
MASTER KEY
TOKENS
TYPES
PROGRAM STEPS X
FORM 1: I WANT (+)
BASELINE
TRAINING
9-14-77
5-11-79
CLASS
9-20-77
5-8-79
UNIT
9-16-77C
5-7-79
DINING HALL
1-23-78
5-2-79
ART
CUMULATIVE OCCURRENCES
OBSERVATION BLOCKS

Figure 40

SUBJECT: JM

SITE: KNI

FORMS: BY SETTING

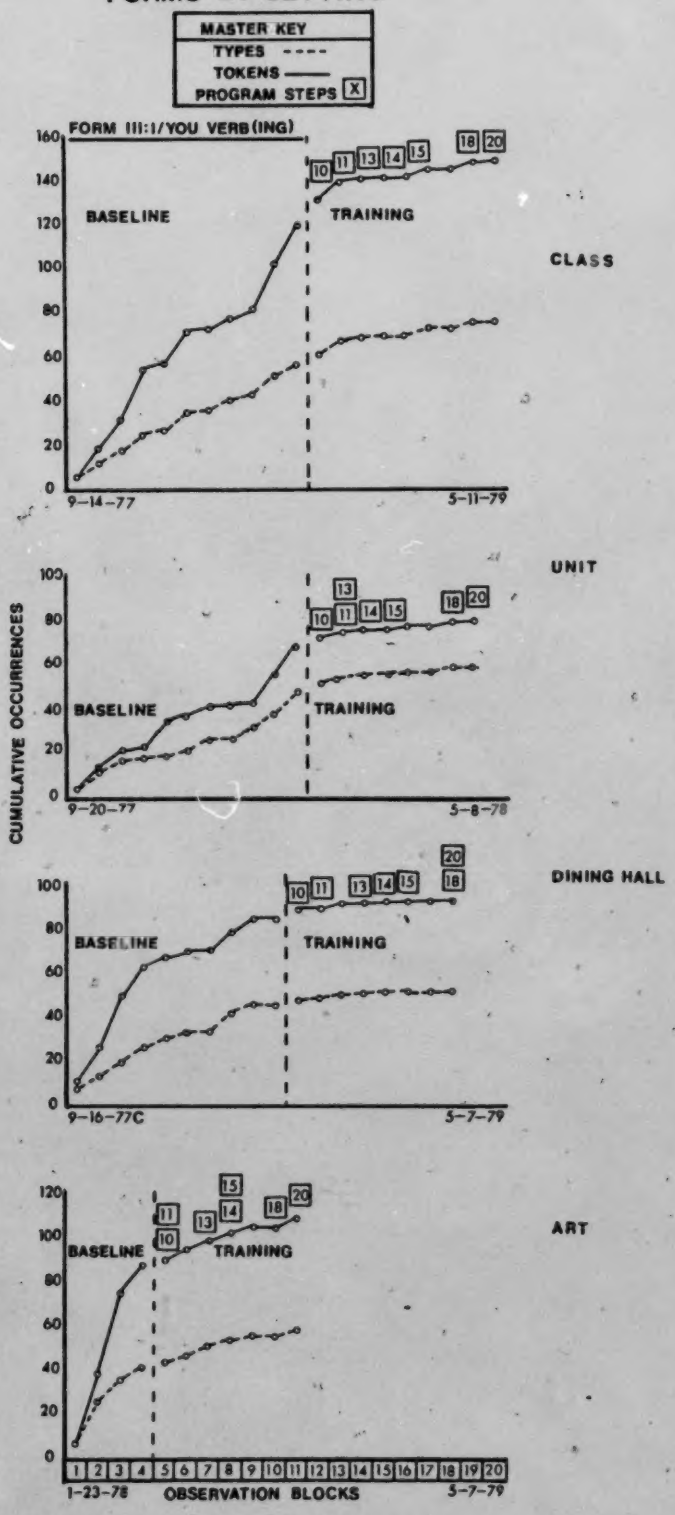


Figure 41

SUBJECT:JM SITE:KNI

FORMS: BY SETTINGS

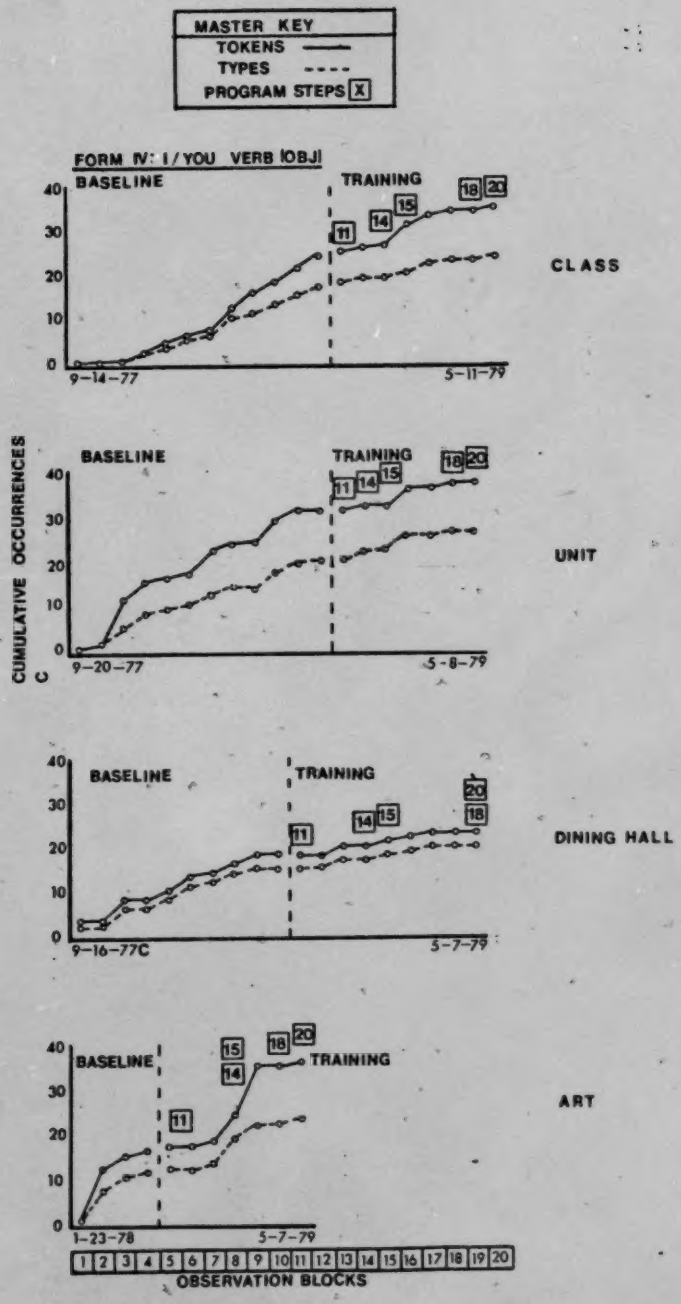


Table 15

KNI Generalization Summary

Subject	Length of Training / Length of Obs.	Guess, Sailor, & Baer Structure Generalization				Mean Length of Utterance	Standardized Tests	
		I want (X)	What (that)? (doing)?	I/You (verb) (ing)	I/You (verb) (object)		Peabody M.A.	Houston M.A.
S.C.	60 mo. / 30 mo.	Generalized (11 exemplars)	No Effect (3 exemplars)	No Effect (3 exemplars)	No Effect (7 exemplars)	Decreased from 1.4 to 1.35	Increased from 2.3 to 3.7	N.A.
K.O.	4 mo. / 4 mo.	Acquired (1 exemplar)	No Effect (3 exemplars)	Not Trained	Not Trained	Decreased from 1.5 to 1.32	N.A.	N.A.
S.I.	48 mo. / 20 mo.	Acquired (6 exemplars)	No Effect (3 exemplars)	No Effect (4 exemplars)	No Effect (3 exemplars)	Decreased from 1.67 to 1.46	Increased from 2.3 to 2.11	Decreased from 31 mo. to 26 mo.
B.H.	14 mo. / 14 mo.	Generalized (1 exemplar)	No Effect (3 exemplars)	Not Trained	Not Trained	Decreased from 1.65 to 1.41	No Change 1.9 to 1.9	Increased from 17 mo. to 20 mo.
C.L.	19 mo. / 19 mo.	Generalized (6 exemplars)	No Effect (2 exemplars)	No Effect (9 exemplars)	Generalized (9 exemplars)	Decreased from 2.2 to 2.05	Decreased from 2.1 to 2.0	Increased from 31 mo. to 33 mo.
T.G.	22 mo. / 22 mo.	Generalized (9 exemplars)	No Effect (3 exemplars)	Acquired (6 exemplars)	Generalized (7 exemplars)	Increased from 1.8 to 2.05	Decreased from 3.8 to 3.0	Increased from 35 mo. to 36 mo.
D.X.	60 mo. / 30 mo.	Generalized (5 exemplars)	No Effect (3 exemplars)	Acquired (3 exemplars)	Generalized (2 exemplars)	Decreased from 1.5 to 1.45	Decreased from 2.7 to 1.11	Increased from 24 mo. to 27 mo.
W.W.	14 mo. / 6 mo.	Generalized (5 exemplars)	No Effect (3 exemplars)	Generalized (5 exemplars)	Generalized (3 exemplars)	Increased from 2.04 to 2.15	N.A.	N.A.
J.M.	56 mo. / 16 mo.	Generalized (9 exemplars)	No Effect (3 exemplars)	No Effect (6 exemplars)	No Effect (5 exemplars)	Increased from 2.3 to 2.4	Increased from 1.11 to 2.0	Increased from 20mo. to 22 mo.
		Stremel & Waryas Structure Generalization						
K.M.	36 mo. / 12 mo.	Acquired the Noun-Verb/Verb-Noun form (3 training steps)				Increased from 1.63 to 2.30	N.A.	N.A.
B.T.	18 mo. / 18 mo.	Acquired the Nominal-Verb/Verb-Nominal form (3 training steps) Generalized Pronoun-Verb form				Increased from 2.18 to 3.14	N.A.	N.A.

Two of eleven KNI subjects were trained on the Stremel and Waryas language training program. A general structure was the target of training for each child. Both children acquired this form, but the effects of training were unclear because the subjects exhibited some use of these structures when training began. One structure, Pronoun-Verb, trained for B.T., generalized as a direct result of training. Both subjects showed strong increases in mean length of utterance (they were the only KNI subjects who showed these gains).

Nine subjects were trained on the Guess, Sailor, and Baer program. For all nine, training on the structure "I want (X)" proved very effective with clear generalization effects for seven and acquisition of the form by the other two. For seven subjects at least five different training steps incorporating this structure were trained. This "multiple exemplar" format may have been partially responsible for generalization. In contrast, none of the nine subjects generalized the structure "What (that) (doing)?" although this form was trained in three consecutive training steps. Apparently this form has little function for severely retarded institutionalized children. These subjects rarely asked questions of any form.

There was no effect of training the structure "I/You (verb) (ing)" for four of seven subjects. One subject generalized and two others acquired the form independent of training. Overall, this structure did not appear to be functional within the institutional environment. However, the structure "I/You (verb) (object)," which can be used to request objects and actions, generalized for four of seven subjects. No effect was observed for three of the subjects.

None of the nine subjects trained on the Guess, Sailor and Baer language training program showed a significant increase in mean length of utterance during the training. Some changes were apparent on the standardized assessment, both positive and negative. The relevance to and accuracy of these tests for severely retarded subjects is questionable. In several cases it was not possible to administer the tests due to subjects' extremely short attention spans and disruptive behavior in the test situation. Furthermore, when scores were derivable, they varied widely from test to test and thus, appeared to be unreliable indicators of the subjects' actual abilities.

The vocabulary generalization by KNI subjects was generally good. Such training appears to be highly functional for severely retarded children and an appropriate basis from which to initiate training on linguistic structures.

The longitudinal generalization analysis suggests that some parts of the Guess, Sailor and Baer program are very effective and other parts are not. Training "I want (X)" form and noun referents is clearly a functional aspect of language training for this population. "I/You (verb) (ing)" and "I/You (verb) (object)" may sometimes be functional.

Changes in the format of training (additional examples, conversational format, etc.) may be sufficient to increase the generalization of these forms. Training question forms "What (that) (doing)?" was not functional and new approaches to teaching these behaviors need to be developed.

The findings demonstrate that severely retarded institutionalized children can be taught critical communication skills that will generalize to the natural environment. The findings also suggest that more effective means are needed and should be the subject of research efforts.

It was difficult to determine if language training had a general impact on the social-communicative and cognitive skills of these subjects. Little change on most measures related to linguistic competence (MLU, complexity variables, standardized assessments) occurred. Difficulty in measuring all but specific, observable aspects of production with this population is a confounding variable that prohibits a strong statement about cognitive abilities.

In many cases even the direct effects of training were not obvious immediately with this population. Clear experimental designs were difficult to establish because substantial changes in subject verbal behavior are infrequent. Typically, changes gradually became apparent over the duration of training and many months of naturalistic observation. Yet, it is likely that changes in language skills are training effects because severely retarded subjects typically demonstrate poor learning from the natural environment, particularly in unstructured situations. The possibility that delayed acquisition is the result of unprogrammed learning by the subjects in the institutional environment is remote.

In summary, parts of the Guess, Sailor and Baer program appear to work effectively, at least eventually, and parts of it should be revised to increase the prospects for generalization by its consumers.

LPP Results

Generalization data were collected on 13 mild to moderately language delayed preschool children enrolled in language training at the Language Project Preschool at the University of Kansas in Lawrence. All subjects ranged in age from 3 to 5 years of age and received training on the Stremel and Waryas language training program. Language generalization data was primarily taken during free play period at the preschool. However, for several of the subject's observations were also taken during free play time in another preschool classroom or at the child's home. The results for each subject are briefly described below and graphic presentations of their structure generalization are shown. Each subject's complexity data and rate code analysis are presented graphically in Appendix 5. A discussion of the results for LPP subjects follows the results presentation.

Subject: D.K. Sex: Female Age: 3.11 to 4.2

Training

D.K. attended LPP from January, 1978, through May, 1978. She was trained on 30 nouns, 20 verbs and 20 adjectives. She was then trained to criterion on the structure Noun-Verb-Noun (3-22-78 to 5-3-78, 20 exemplars).

Assessment

The results of the PPVT, STACL, and Houston (Part II) are listed below:

	PPVT	STACL	Houston
January 1978	M.A. 2-2	19%ile	3 yr. level

Word Generalization

D.K. was observed 27 times at LPP from February to May of 1978. The word generalization ratios were:

	One Occasion	Two Occasions
Nouns	7/30 = .23	1/30 = .03
Verbs	5/20 = .25	0/20 = 0
Adjectives	1/20 = .05	0/20 = 0
TOTAL	13/70 = .19	1/70 = .01

D.K.'s vocabulary included 241 words.

Structure Generalization

The form Noun-Verb-Noun did not occur in the data.

Complexity Effects

Both MLU and Upperbound increased over the observational period (MLU: from 2.5 to 3.0; Upperbound: 6 to 11 morphemes). Other complexity measures revealed slight increases (except Modifiers per utterance). The mean rates were observation of nominals, verbs, modifiers, and function words dropped over the observational period.

Rate Effects

A total of 25 observations were taken at LPP. D.K.'s mean verbalization rate was 25 utterances per observation (mean initiation rate: 16 per observation). The mean percentage of obligatories answered was 68%. The percentage of consequent behaviors dropped over the observation period from 26 to 12%.

Summary

No training effects were evident. Word generalization was low but data were limited. Her language complexity increased somewhat.

Subject: K.S. Sex: Male Age: 3.10 to 4.11

Training

K.S. attended LPP from February, 1978, to March, 1979. During that time the following structures were trained: Verb-Noun (4-6-78 to 7-27-78, 20 exemplars); Noun-Verb-Noun (9-13-78 to 11-21-78, 30 exemplars); Pronoun-State Verb-Noun (11-30-78 to 2-12-79, 20 exemplars); Adjective-Noun (11-30-78 to 3-1-79, 20 exemplars). Criterion was met for all structures except Adjective-Noun. The preposition "under" was trained from 10-26-78 to 11-29-78 but criterion was not met. Average training time per structure was 19.25 sessions.

Assessments

The results of the PPVT, STACL and Houston (Parts I and II) are presented below.

	PPVT	STACL	Houston
December 1977	M.A. 2-3	------	31 mo. level(I)
September 1978	M.A. 3-6	7%ile	-3yr. level(II)
December 1978	M.A. 3-0	45%ile	3 yr. level(II)

Word Generalization

K.S.'s vocabulary included 330 words.

Structure Generalization

The trained syntax was collapsed into two general classes for analysis: Verb-Nominal/Modifier-Nominal and Nominal-Verb-Nominal. There were no occurrences of either form during baseline. A short time after training commenced both forms generalized. These generalization data are presented in Figures 42.

Complexity Effects

MLU increased from 1.40 tc 2.70 over the observational period. Upperbound rose from five to eight morphemes. Other complexity measures showed steady increases. The mean number of nominals, verbs, modifiers and function words per observation also increased.

Rate Effects

Rate observations were taken from February, 1978, through December, 1978. The mean rate of child verbalization and initiations doubled over the observational period. The percentage of obligatory language situations responded to rose from 37% to 79%.

Summary

Data revealed clear training effects and an overall development of language that accelerated during the second half of the longitudinal analysis. K.S.'s verbalization rate doubled and the diversity of his vocabulary usage increased. The standard assessment indicated his language was developing at a reasonable rate, but was still delayed for his age.

Subject: C.Z. Sex: Male Age: 4.5 to 5.1

Training

C.Z. attended LPP from September, 1977, to May, 1978. He was trained on 57 Nouns in 42 sessions. He was also trained on the structure Verb-Noun (12-5-77 to 6-16-78, 30 exemplars) in 43 sessions.

Assessment

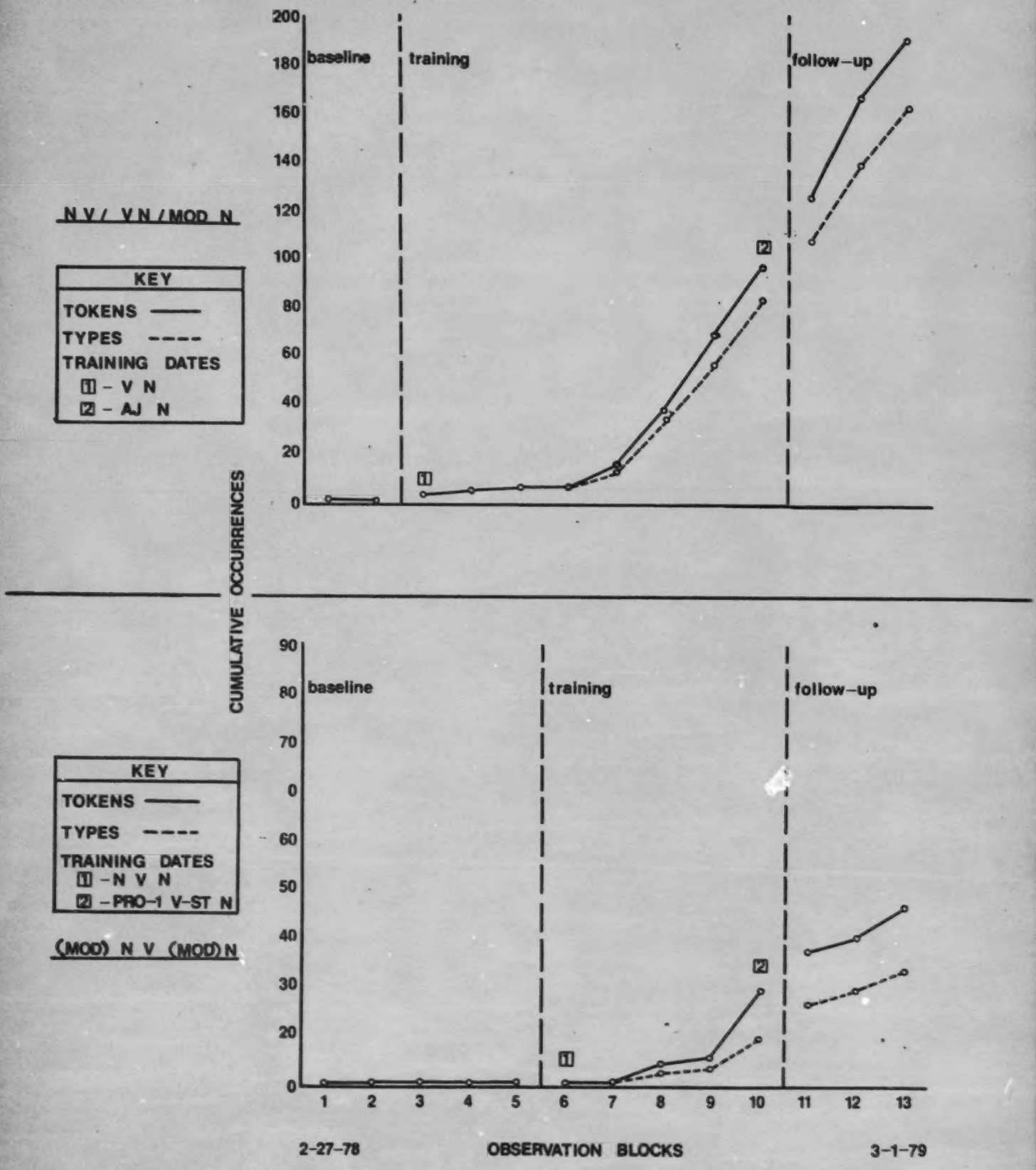
The results of the PPVT and the Houston (Part II) are presented below.

SUBJECT: KS

Figure 42

SITE: LAWR

COLLAPSED FORMS: SETTINGS COMBINED



	PPVT	Houston
September 1977	Untestable	Untestable
December 1977	M.A. 2-6	below 3 yr. level
May 1978	M.A. 2-10	3 yr + level

Word Generalization

Thirty-four verbatim observations were taken at LPP from November, 1977, through May, 1978. The word generalization ratios were: one occasion - 16/57 = .28; 2 occasions - 5/57 = .09. C.Z.'s vocabulary included 283 words.

Structure Generalization

C.Z. was producing Verb-Noun combinations before training began. A lack of adequate baseline data made it difficult to determine if training accelerated his use of the form. C.Z.'s data are shown in Figure 44.

Complexity Effects

MLU increased from 2.25 to 3.10, but then decreased to 2.65. Upperbound rose from seven to 10 morphemes. Other complexity measures showed slight increases, most notable, in verbs per utterance, which increased from .35 to 1.00. The mean rates of nominals, verbs, modifiers, and function words increased.

Rate Effects

Forty-seven rate observations were taken from September, 1977, through May, 1978. C.Z.'s total verbalizations and initiations showed substantial increases over the observational period. The mean percentage of obligatory situations responded to increased from 58% in fall, 1977, to 78% in spring, 1978.

Summary

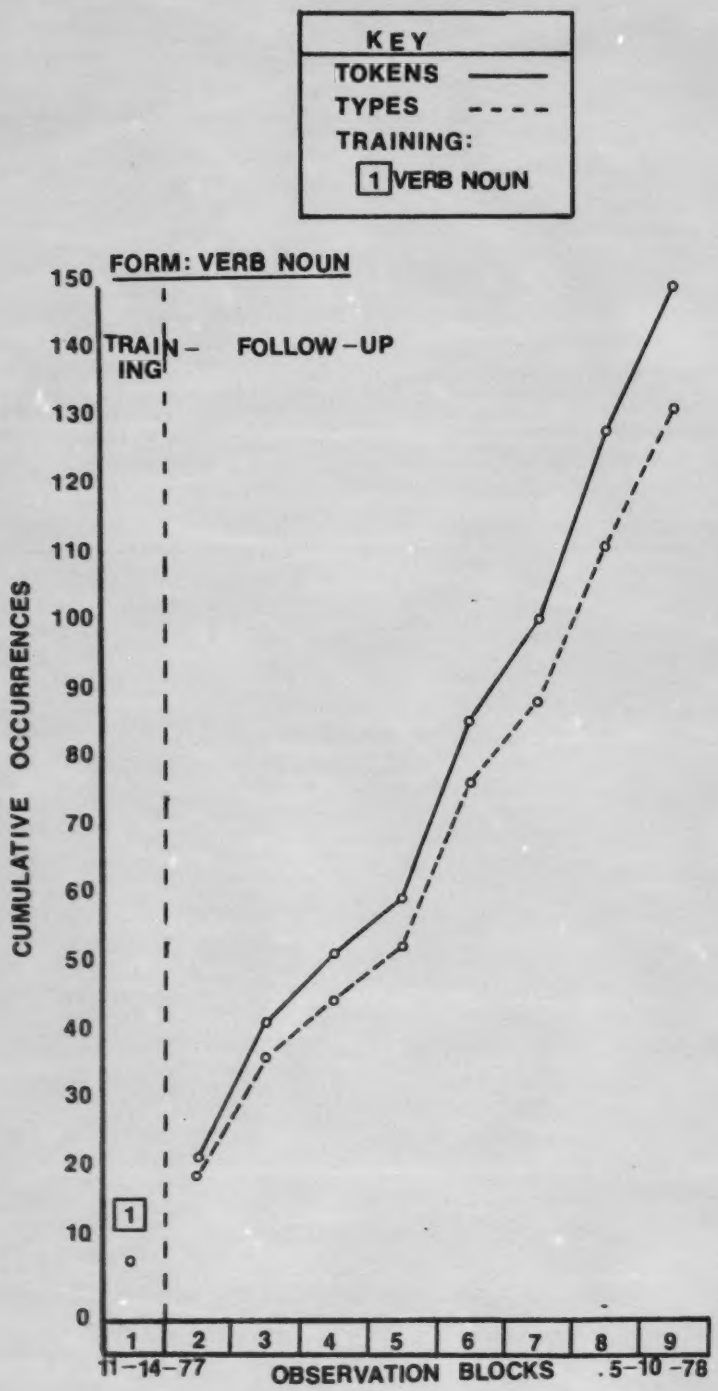
C.Z.'s language complexity increased somewhat, largely due to increases in the number of verbs per utterance. Rate measures showed increases. C.Z.'s language diversity increased very little as evidenced by low word generalization ratios, small vocabulary acquisition, and small gains in the mean rates of the four major word categories. C.Z.'s hearing loss was the major obstacle to natural vocabulary acquisition.

Figure 44

SUBJECT: CZ

SITE: LAWR.

COLLAPSED FORMS



Subject: W.A. Sex: Male Age: 3.10 to 4.6

Training

W.A. attended LPP from February, 1977, through May, 1978. He was trained on the following structures: Noun-Verb-Preposition-Noun (10-24-77 to 11-9-77, 10 exemplars); Adjective-Noun (1-24-77 to 11-14-77, 10 exemplars); Pronouns-Progressive Verb (11-14-77 to 12-1-77, 14 exemplars); Pronoun-Progressive Verb-Pronoun (2-21-78 to 3-7-78, 10 exemplars); Pronoun-Verb-pronoun (3-22-78 to 4-1-78, 10 exemplars). Criterion was reached on all forms except Pronoun-Progressive Verb. The mean number of sessions spent training each form was 9.6.

Assessments

The results of the PPVT, STACL and Houston (Part II) are presented below:

	PPVT	STACL	Houston
August 1977	M.A. 3-1	54%ile	4 yr. level
December 1977	M.A. 3-8	90%ile	4 yr. + level
May 1978	M.A. 4-0	90%ile	5 yr. level

Word Generalization (not applicable) W.A.'s vocabulary included 439 words.

Structure Generalization

A total of 60 verbatim observations were taken (LPP - 52; other preschool-8). The trained structures were collapsed into three general classes: Modifier-Nominal/Nominal Verb, Nominal-Verb-Nominal, and Nominal-Verb-Preposition-Nominal. Occurrences of these three forms are presented in Figure 45. No training effects were evident. The form Noun-Verb-Preposition-Noun occurred once during training.

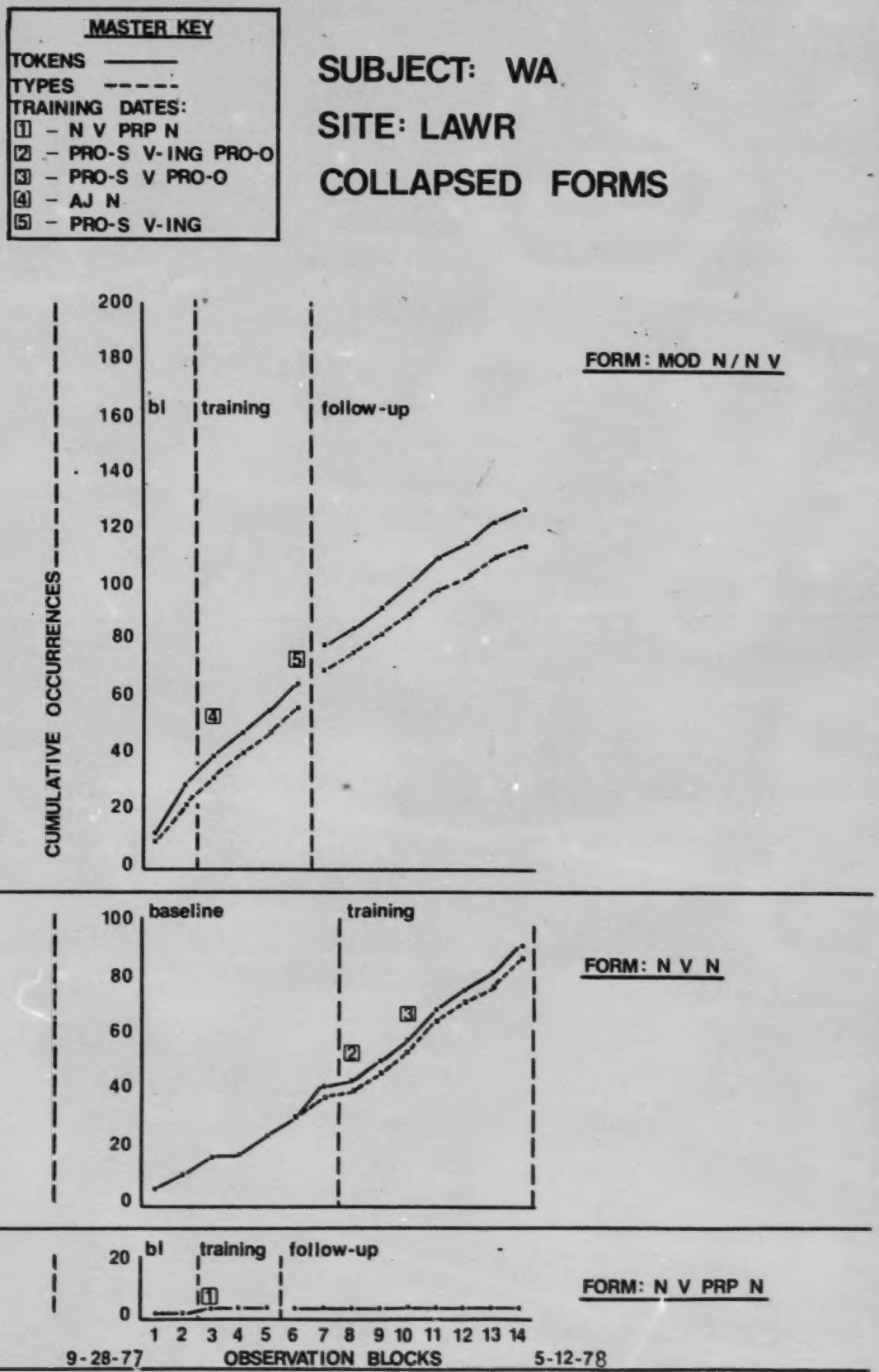
Complexity Effects

MLU ranged from 2.50 to 3.35 increasing very little over time. Upperbound was variable, ranging from seven to 11 morphemes showing a slight increase over time. Other complexity measures indicated very little improvement. The mean rates of nominals, verbs, modifiers, and function words per observation increased.

Rate Effects

Rate observations were taken from February, 1977, through May, 1978. These data revealed virtually no change in verbalization rate, obligatories answered (about 65%) or consequent behaviors.

Figure 45



NO OCCURRENCE OF THE FORM: (MOD) N V V (MOD) N

Summary

W.A.'s verbal behavior changed very little during his attendance at LPP. Standardized tests indicated improvement, but classroom data did not show improvement.

Subject: M.J. Sex: Male Age: 3.0 to 4.7

Training

M.J. attended LPP from September, 1976, to May, 1978. He was trained on 57 Nouns in 22 sessions and eight Verbs in six sessions. The following structures were trained: Pronoun-State Verb-Noun (11-17-76 to 2-22-77, 50 exemplars); Color-Adjective-Noun (2-28-77 to 4-4-77, 20 exemplars); Noun-Verb-Noun (4-6-77 to 4-28-77, 10 exemplars); Noun-Verb-Color Adjective-Noun (10-20-77 to 11-15-77, 10 exemplars); Noun-Verb-Adjective-Noun (11-28-77 to 12-1-77, 10 exemplars); Pronoun-Verb(ing)-Possessive Pronoun-Noun (2-21-78 to 3-21-78, 10 exemplars); Pronoun-Verb-Pronoun (3-22-78 to 4-24-78, 10 exemplars). Criterion was reached on all structures except Noun-Verb-Adjective-Noun. The mean number of training sessions per structures was 9.85.

Assessments

The results of the PPVT, STACL, and Houston (Part II) are listed below:

	PPVT	STACL	Houston
January 1977	M.A. 2-5	30%ile	3 yr. level
May 1977	M.A. 2-11	61%ile	3 yr. + level
September 1977	M.A. 3-6	54%ile	4 yr. + level
December 1977	M.A. 4-2	54%ile	4 yr. + level
May 1978	M.A. 4-8		5 yr. level

Word Generalization

A total of 131 observations were taken at LPP. Word generalization ratios are presented below.

	One Occasion	Two Occasions
Nouns	29/57 = .51	22/57 = .39
Verbs	3/8 = .38	3/8 = .38
TOTAL	32/65 = .49	25/65 = .38

M.J.'s vocabulary included 871 words.

Structure Generalization

The trained structures were collapsed into three general classes for analysis: Noun-Verb/Modifier-Noun, (Modifier)-Noun-Verb-(Modifier)-Noun, (Modifier)-Noun-Verb-Preposition-(Modifier)-Noun. Noun-Verb/Modifier-Noun data revealed some training effects. However training appeared to coincide with some natural acquisition thus, increases resulting specifically from training were difficult to isolate. The Noun-Verb-Noun data showed training effects and accelerated use of the form as training continued. A small, delayed, training effect occurred for the form Noun-Verb-Preposition-Noun. These generalization data are presented in Figures 46-47.

Complexity Effects

MLU increased steadily from 1.35 to 3.75. Upperbound climbed from four to about 12 morphemes. All other measures showed steady gains, except function words per utterance, which maintained the same proportion throughout the analysis. The rates of nominals, verbs, modifiers, and function words increased (both types and tokens).

Rate Effects

A total of 152 rate observations were taken from September, 1976, through May, 1978. M.J.'s total verbalization rate reached a mean of 40 per observation. The mean initiation rate increased from 10 to 30 per observation. Teacher verbalizations to M.J. decreased over time.

Summary

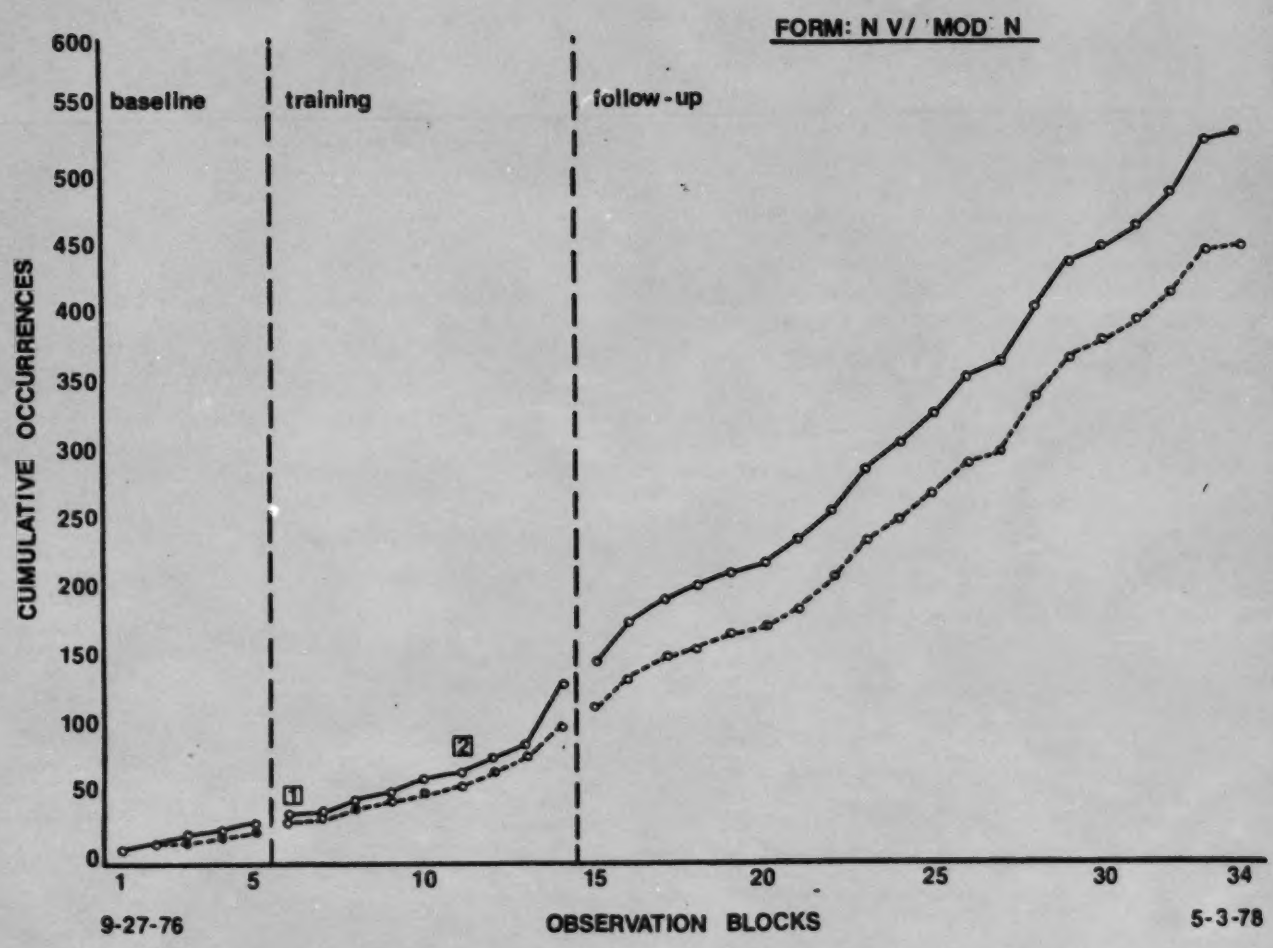
M.J. acquired new structures rapidly in training and some generalization occurred. His assessment scores advanced to a level appropriate to his chronological age. Overall language performance improved.

Subject: D.N. Sex: Male Age: 4.0 to 5.8

Training

D.N. attended LPP from September, 1977, through May, 1979. He was trained on the following structures: Noun-Progressive Verb (10-24-77 to 12-1-77, 20 exemplars); Color Adjective-Noun (1-18-78 to 3-1-78, 10 exemplars); Noun-Verb-Noun (1-18-78 to 3-20-78, 20 exemplars), Adjective-Noun (3-20-78 to 4-27-78, 20 exemplars); Noun-Verb-Color Adjective-Noun (3-21-78 to 4-13-78, 10 exemplars); Noun-Progressive Verb-Preposition-Noun (4-17-78 to 9-28-78), Noun-Verb-Preposition-Adjective-Noun (10-9-78 to 11-21-78, 20 exemplars); Pronoun-Auxiliary Verb-Progressive Verb-Article-Noun (11-28-78 to

Figure 46


MASTER KEY
TOKENS
TYPES
TRAINING DATES
[1] - V N
[2] - AJ-COL N
SUBJECT: MJ
SITE: LAWR
COLLAPSED FORMS
FORM: N V/ 'MOD' N
baseline
training
follow-up
CUMULATIVE OCCURRENCES
600
550
500
450
400
350
300
250
200
150
100
50
0
1
5
10
15
20
25
30
34
9-27-76
OBSERVATION BLOCKS
5-3-78

SUBJECT: MJ

SITE: LAWR

Figure 47

COLLAPSED FORMS

MASTER KEY

TOKENS ——

TYPES - - - -

TRAINING DATES:

[1]—PRO V PRP AJ N

[2]—PRO V-ST ART N

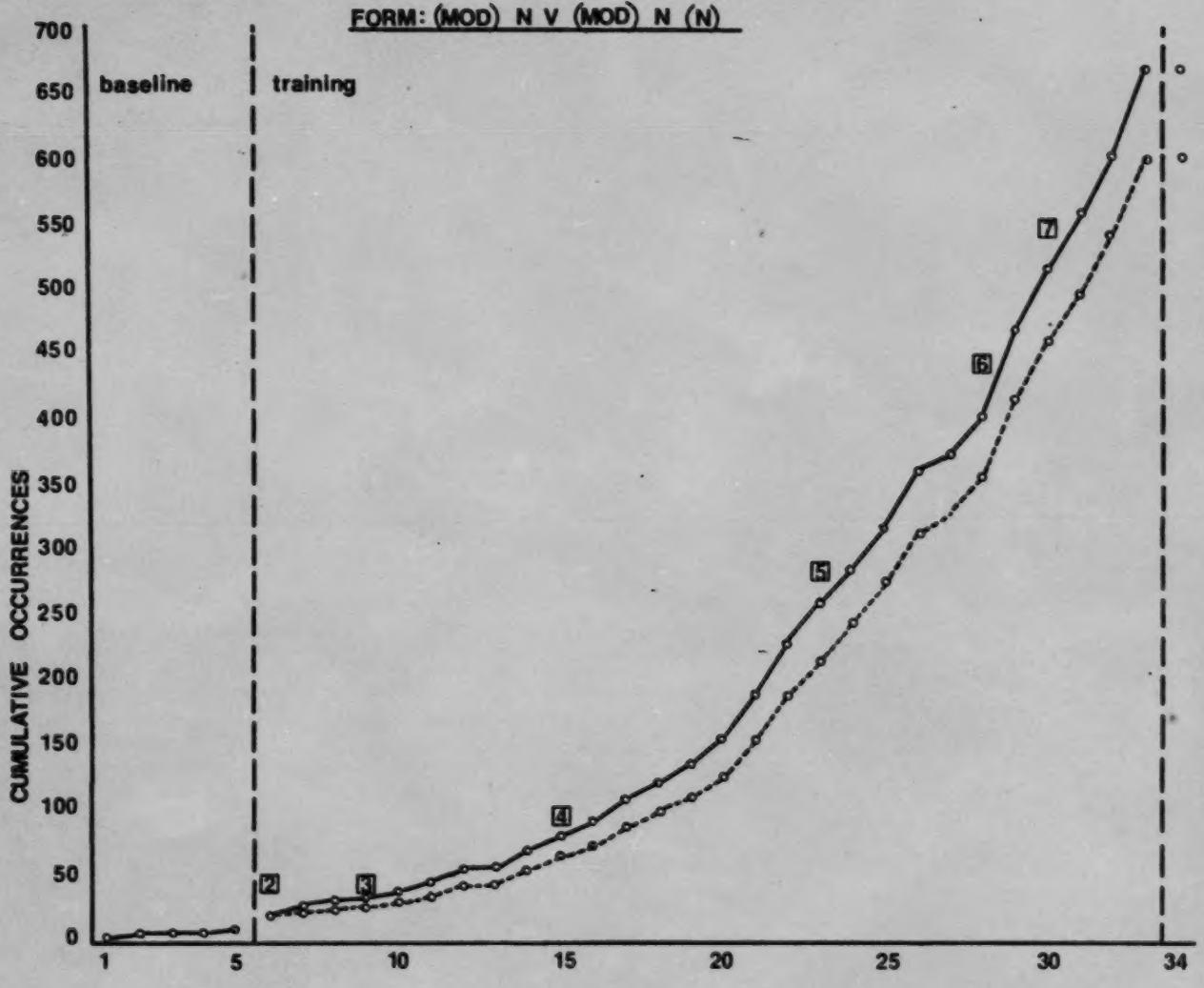
[3]—PRO V-ST N

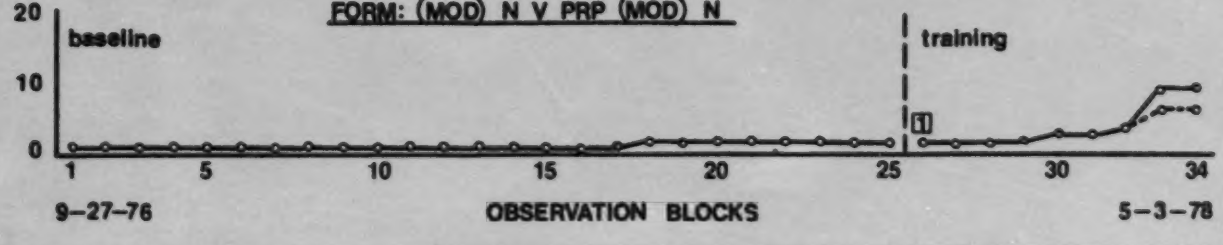
[4]—N-PR V N

[5]—N V AJ-COL N

[6]—PRO V-ING PRO-P N

[7]—PRO V PRO





NO OCCURRENCE OF THE FORM: (MOD) N V V (MOD) N

12-6-78, 10 exemplars). Criterion was reached on all structures except Noun-Progressive-Verb and Pronoun-Verb-Progressive Verb-Article-Noun.

Assessments

The results of the PPVT, STACL Houston (Part II) are presented below:

	PPVT	STACL	Houston
May 1977	M.A. 2-10	-----	-------
September 1977	-----	22%ile	3 yr. + level
December 1977	M.A. 3-7	82%ile	3 yr. + level
May 1978	M.A. 7-1	61%ile	4 yr. level
September 1978	M.A. 6-10	22%ile	4 yr. + level
December 1978	M.A. 7-3	44%ile	4 yr. + level

Word Generalization

D.N.'s vocabulary included 555 words. (no words were trained independently).

Structure Generalization

The structures trained were collapsed into four general classes for analysis: Nominal-Verb/Modifier-Nominal: Nominal-Verb-Nominal; Nominal-Verb-Preposition-Nominal; Nominal-Verb-Verb-Nominal. These data are presented in Figures 48-50. The effects of training are difficult to determine although D.N.'s language development clearly accelerated. D.N. appeared to acquire new language from the natural environment. His increased rates of vocalization may have resulted from socialization in the classroom rather than from structured language training.

Complexity Effects

MLU rose from around 1.6 to nearly 3.2 over the period of analysis. Upperbound increased from five to 11 morphemes. Other complexity measures also showed gains. The mean rates of nominals, verbs, modifiers, and function words rose sharply (both types and tokens).

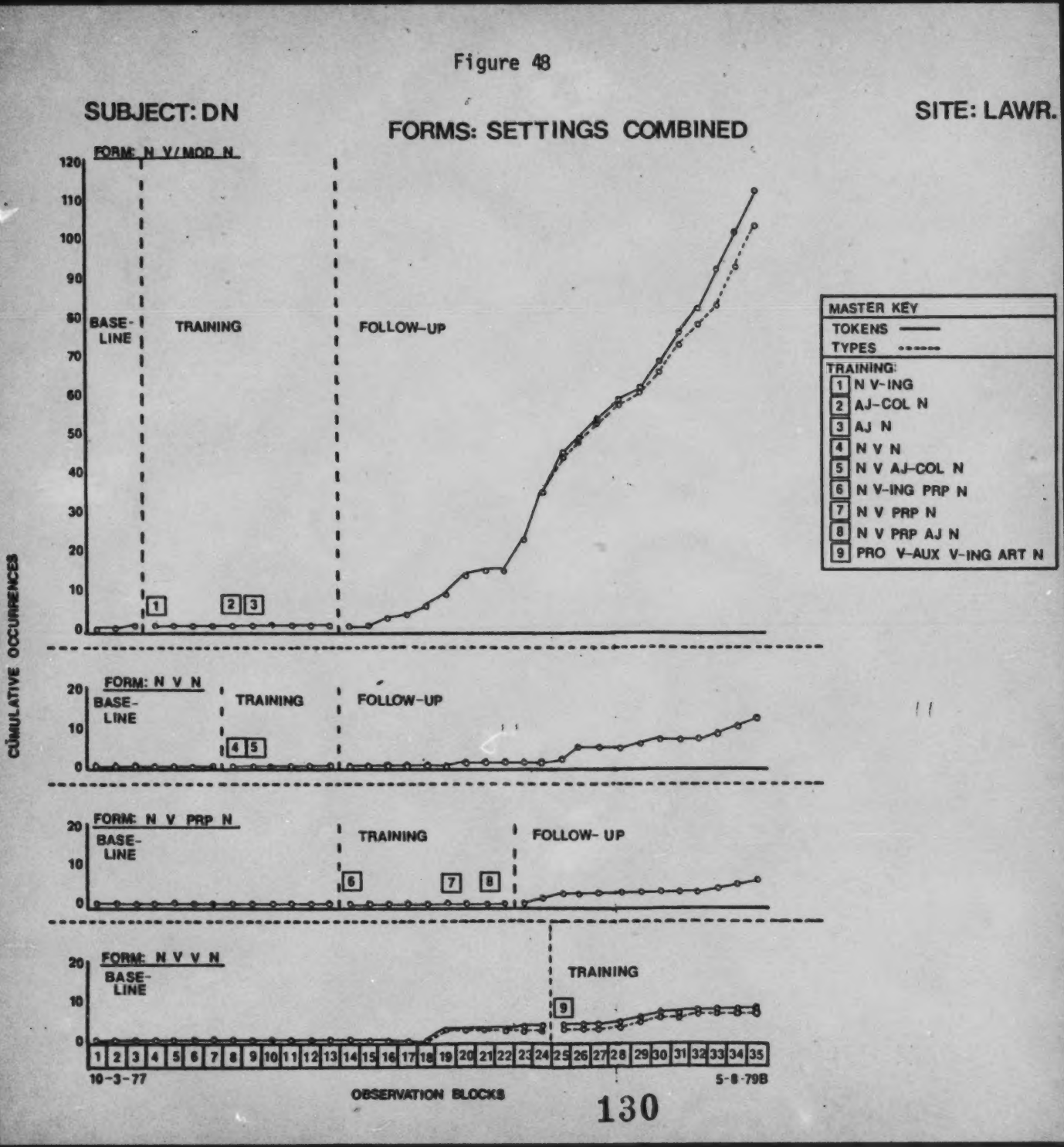
Rate Effects

One hundred two rate observations were taken from September, 1977, through April, 1979. D.N.'s verbalization rate increased to a mean of 30 utterances per observation during the Spring, 1978, semester. The percentage of obligatory situations responded to increased from 20% to over 80%.

Summary

D.N. made impressive language gains, but whether his improvement was due to training was not clear. D.N.'s language rate, complexity and diversity improved greatly, especially during the 1978-79 school year.

Figure 48

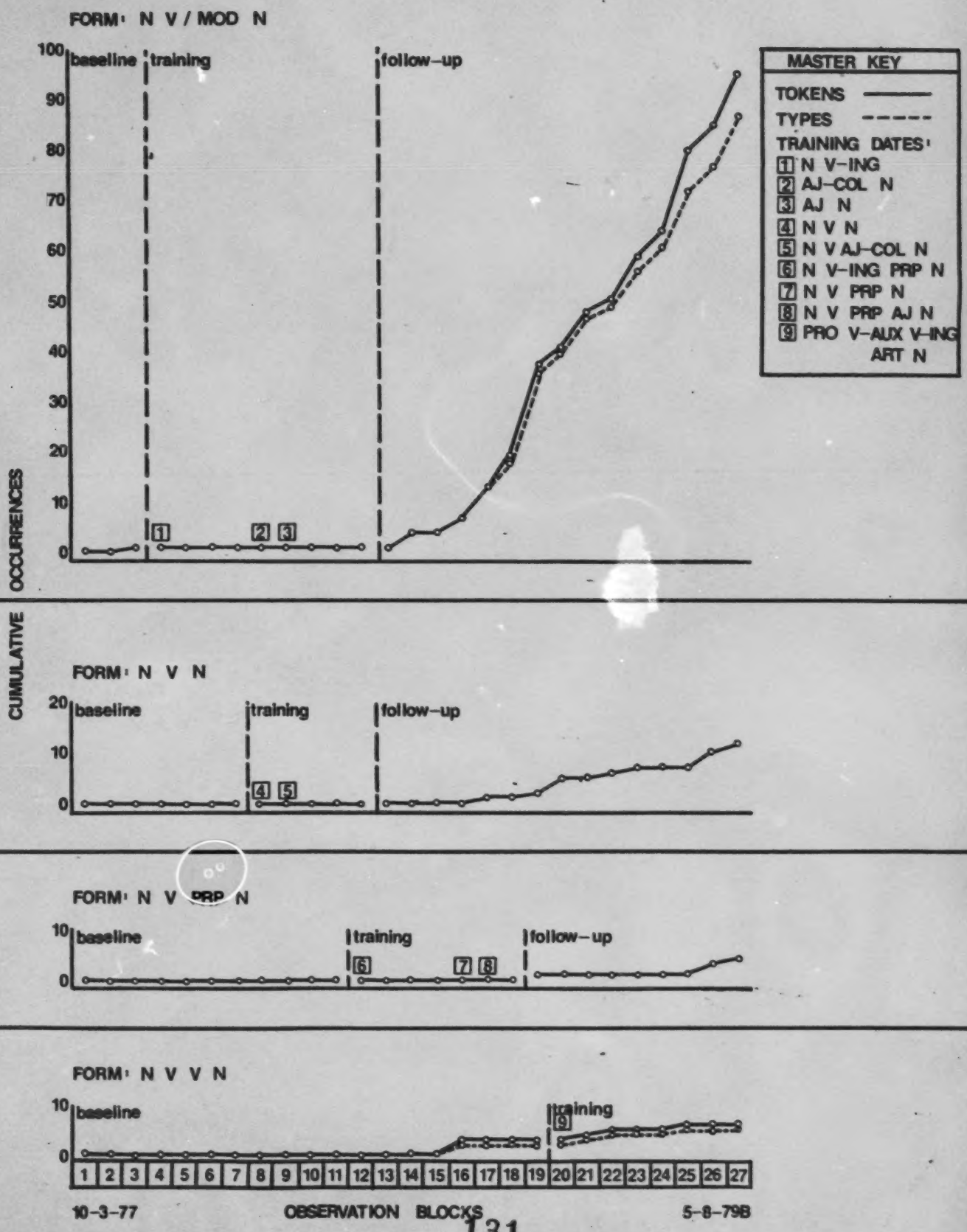

SUBJECT: DN
FORMS: SETTINGS COMBINED
SITE: LAWR.
FORM: N V/MOD N
BASE-LINE
TRAINING
FOLLOW-UP
FORM: N V N
FORM: N V PRP N
FORM: N V V N
MASTER KEY
TOKENS
TYPES
TRAINING:
1 N V-ING
2 AJ-COL N
3 AJ N
4 N V N
5 N V AJ-COL N
6 N V-ING PRP N
7 N V PRP N
8 N V PRP AJ N
9 PRO V-AUX V-ING ART N
CUMULATIVE OCCURRENCES
OBSERVATION BLOCKS
10-3-77
5-8-79B

SUBJECT; DN

SITE; LAWR

Figure 49

FORMS; BY SETTING (LPP)



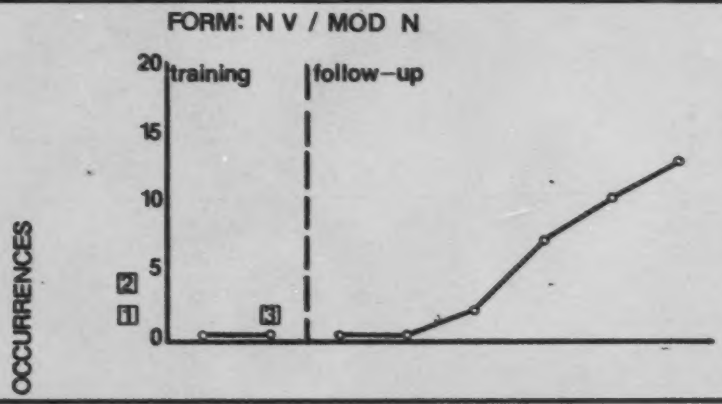
Subject; DN

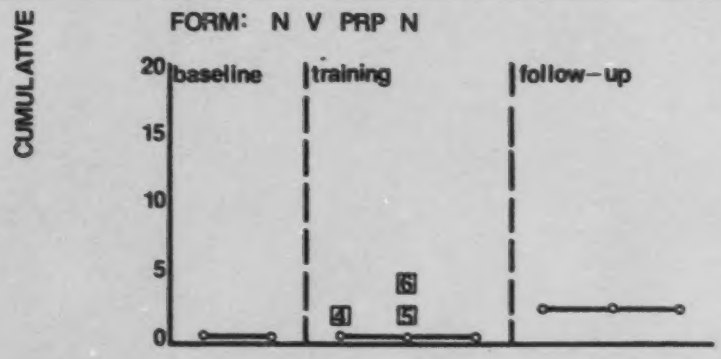
Figure 50

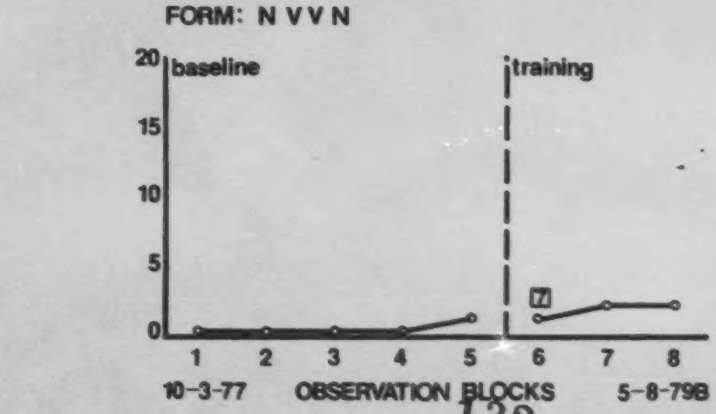
Site; lawr

forms; by setting
hilltop

MASTER KEY	
TOKENS	——
TYPES	- - - -
TRAINING DATES:	
[1] N V-ING	
[2] AJ-COL N	
[3] AJ N	
[4] N V-ING PRP N	
[5] N V PRP N	
[6] N V PRP AJ N	
[7] PRO V-AUX V-ING ART N	







Subject: J.I. Sex: Female Age: 3.3 to 3.11

Training

J.I. attended LPP from September, 1978 through May, 1979. Structural training was deferred in favor of an incidental language intervention. Mands for one-word utterances were instituted because of J.I.'s near normal receptive language abilities starting October 30, 1978; two-word mands began December 6, 1978; a fade-out procedure was initiated on April 30, 1979. (A full description of this procedure is reported in the Environmental Intervention section; McQuarter, Warren, & Rogers-Warren).

Assessments

The results of the PPVT, STACL, and Houston (Part II) are listed below:

	PPVT	STACL	Houston
September 1978	M.A. 2-3	-----	------
December 1978	M.A. 3-8	-----	3 yr. + level
May 1979	M.A. 4-0	61%ile	4 yr. + level

Word Generalization: (Not applicable) J.I.'s vocabulary included 626 words.

Structure Generalization

The term generalization is not applicable in J.I.'s case because the incidental training task place in the classroom. The following forms were chosen for analysis: Nominal-Verb/Verb-Nominal/Modifier-Nominal, (Modifier)-Nominal-Verb(Modifier)-Nominal, (Modifier)-Nominal-Verb-Preposition-(Modifier)-Nominal, and (Modifier)-Nominal-Verb-Negative-Verb-(Modifier)-Nominal. J.I. was observed 79 times (LPP 52; home 27). All of the above forms occurred before the incidental training intervention in both settings. The rates of occurrence of these forms increased significantly during intervention in the LPP setting. These data are presented in Figures 51-52.

Complexity Effects

MLU decreased during the first half of the observational period and then increased back to its original level. Other complexity measures followed a similar pattern. The mean rates of nominals, verbs, modifiers and function words changed little. Those rates were much higher in home observations. Upperbound rose from eight to 13 morphemes.

Rate Effects

A total of 40 rate observations were taken from September, 1978, to April, 1979. J.I.'s rate of verbalization and initiations increased slightly during the spring, 1979, semester but were still low. The mean percentage

Figure 51

SUBJECT: JI

SITE: LAWR.

COLLAPSED FORMS: settings combined

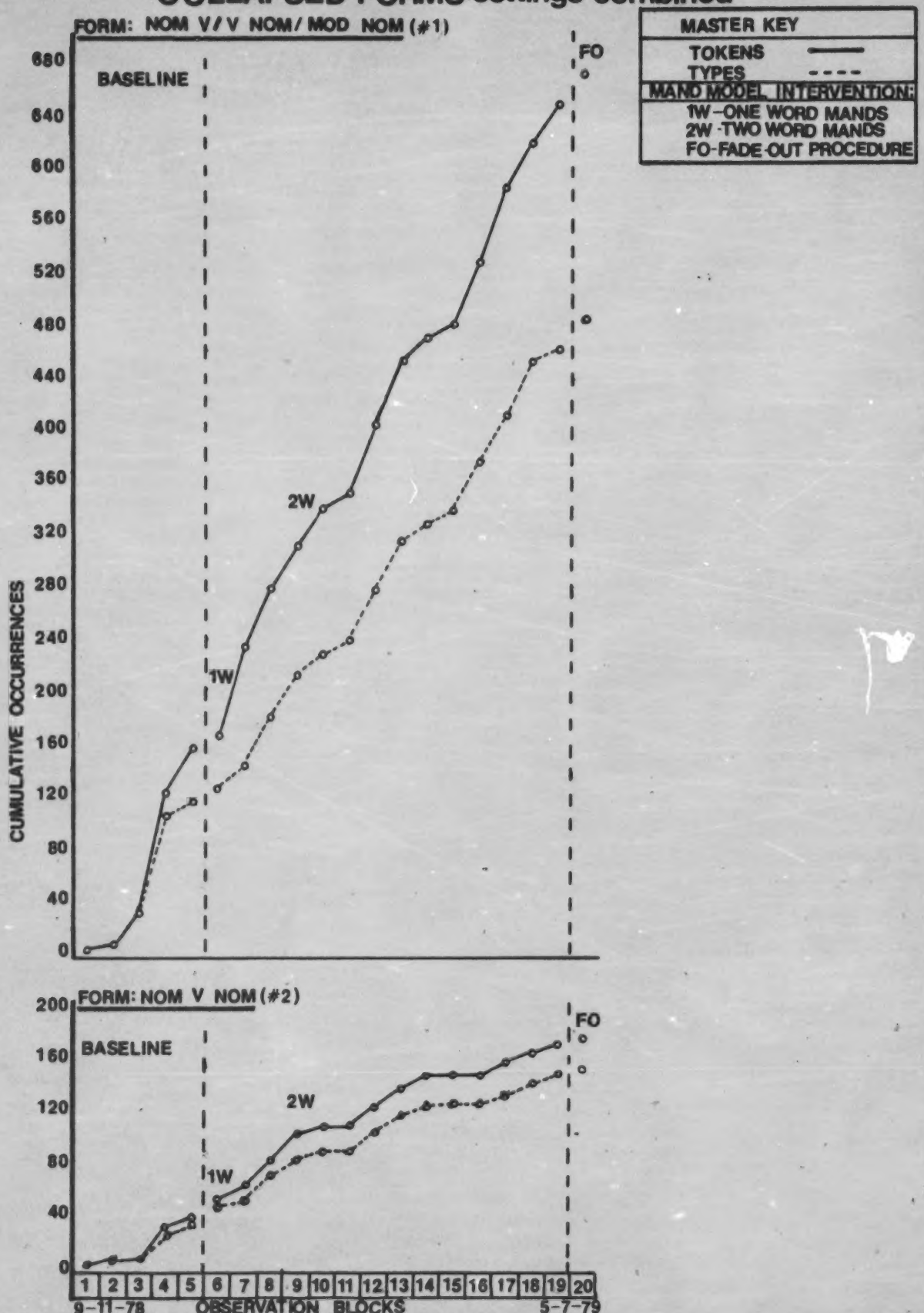
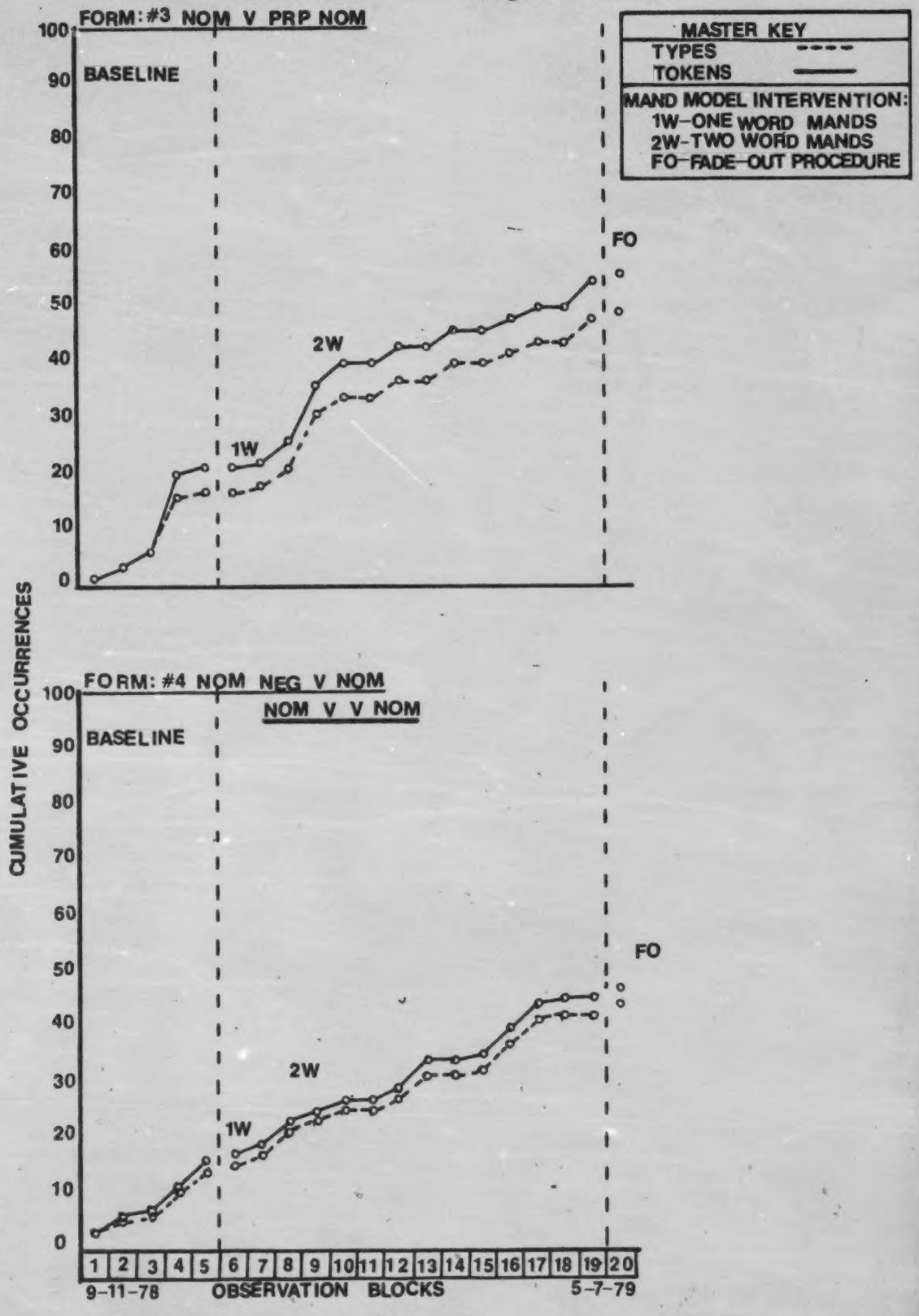


Figure 52

SUBJECT: JI COLLAPSED FORMS: settings combined SITE: LAWR.



of obligatory situations responded to increased from 21% to 48%. Teacher verbalizations to J.I. also increased during the spring of 1979.

Summary

J.I.'s linguistic performance was much better at home than at LPP, and her verbalization rate was much higher. The incidental teacher intervention did alter this although the percentage of obligatories answered increased.

Subject: J.C. Sex: Male Age: 2.5 to 4.0

Training

J.C. attended LPP from September, 1977, through May, 1979. Initially, he was trained on 14 nouns. The following syntactic structures were then trained: Verb-Noun (2-7-78 to 7-27-78, 28 exemplars); Noun-Verb-Noun (9-13-78 to 11-21-78, 30 exemplars); Pronoun-State Verb-Noun (11-27-78 to 2-14-79, 20 exemplars); Adjective-Noun (11-28-78 to 2-28-79, 20 exemplars); Noun-Verb-Adjective-Noun (3-6-79 to 5-1-79, 20 exemplars). The mean training time per structure was 22 sessions; criterion was met on all trained forms.

Assessments

The PPVT, STACL, and Houston (Parts I and II) assessments are listed below:

	PPVT	STACL	Houston
February 1978	M.A., 2-3	49%ile	29.4 mo. level (I)
May 1978	M.A., 2-7	11%ile	3 yr. level (II)
September 1978	M.A., 3-0	74%ile	3 yr. level (II)
December 1978	M.A., 5-1	94%ile	4 yr. level (II)
April 1979	M.A., 4-4	97%ile	4 yr. + level (II)

Word Generalization

J.C. was observed 97 times (LPP-73; Home-21; Other preschools-3). The word generalization ratios were: one occasion, 10/14 = 71%; two occasions, 8/14 = 57%; two settings, 3/14 = 21%, J.C.'s vocabulary included 785 words.

Structure Generalization

The trained syntactic structures were collapsed into two general classes for analysis: Verb-Nominal/Modifier-Nominal, and (Modifier)-Nominal-Verb-(Modifier)-Nominal. The occurrences of these two forms are shown in Figure 53-57. The graphs suggest training had little effect on J.C.'s use of these structures. Furthermore, the initial baselines, though limited, suggest he occasionally used these forms before training.

SUBJECT: JC Figure 53 SITE: LAWR

FORMS: COMBINED SETTINGS

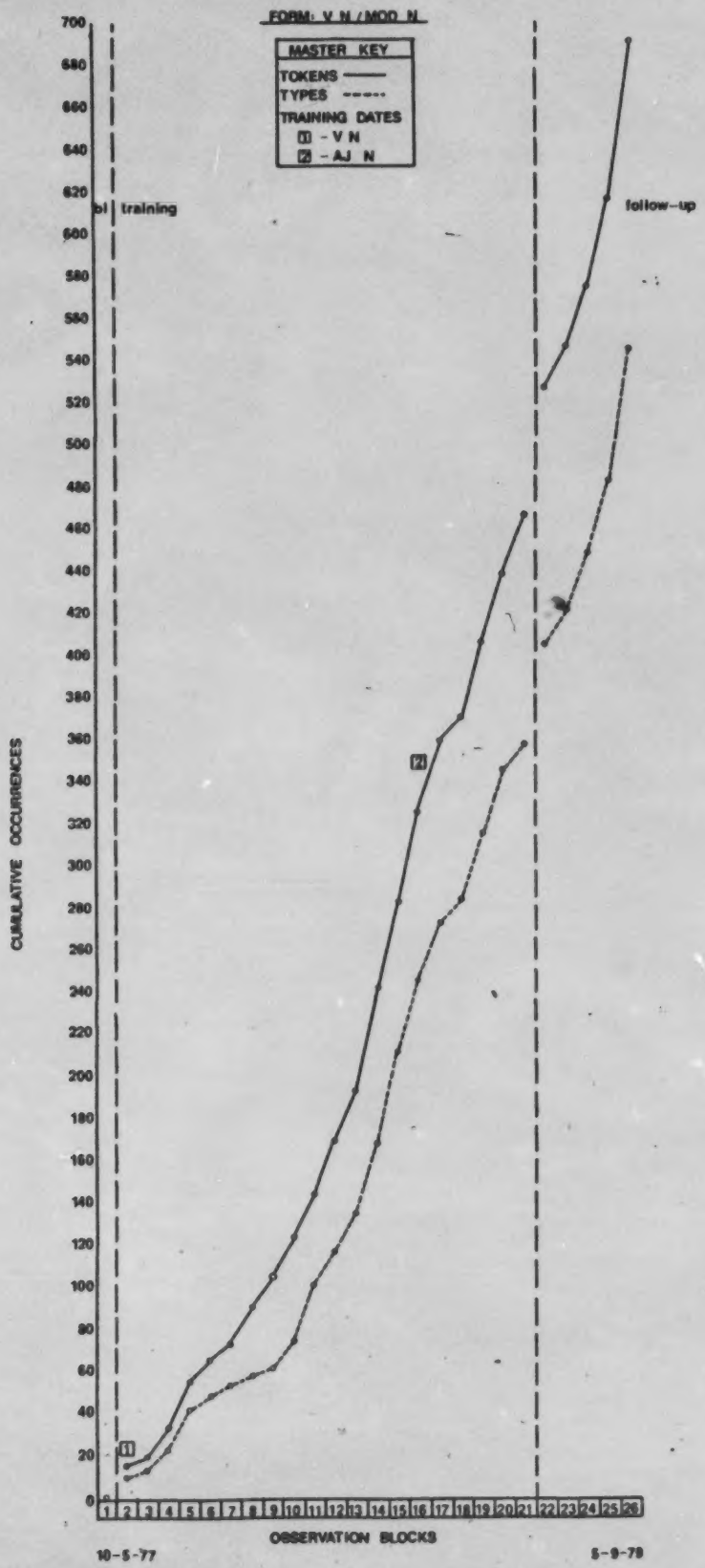
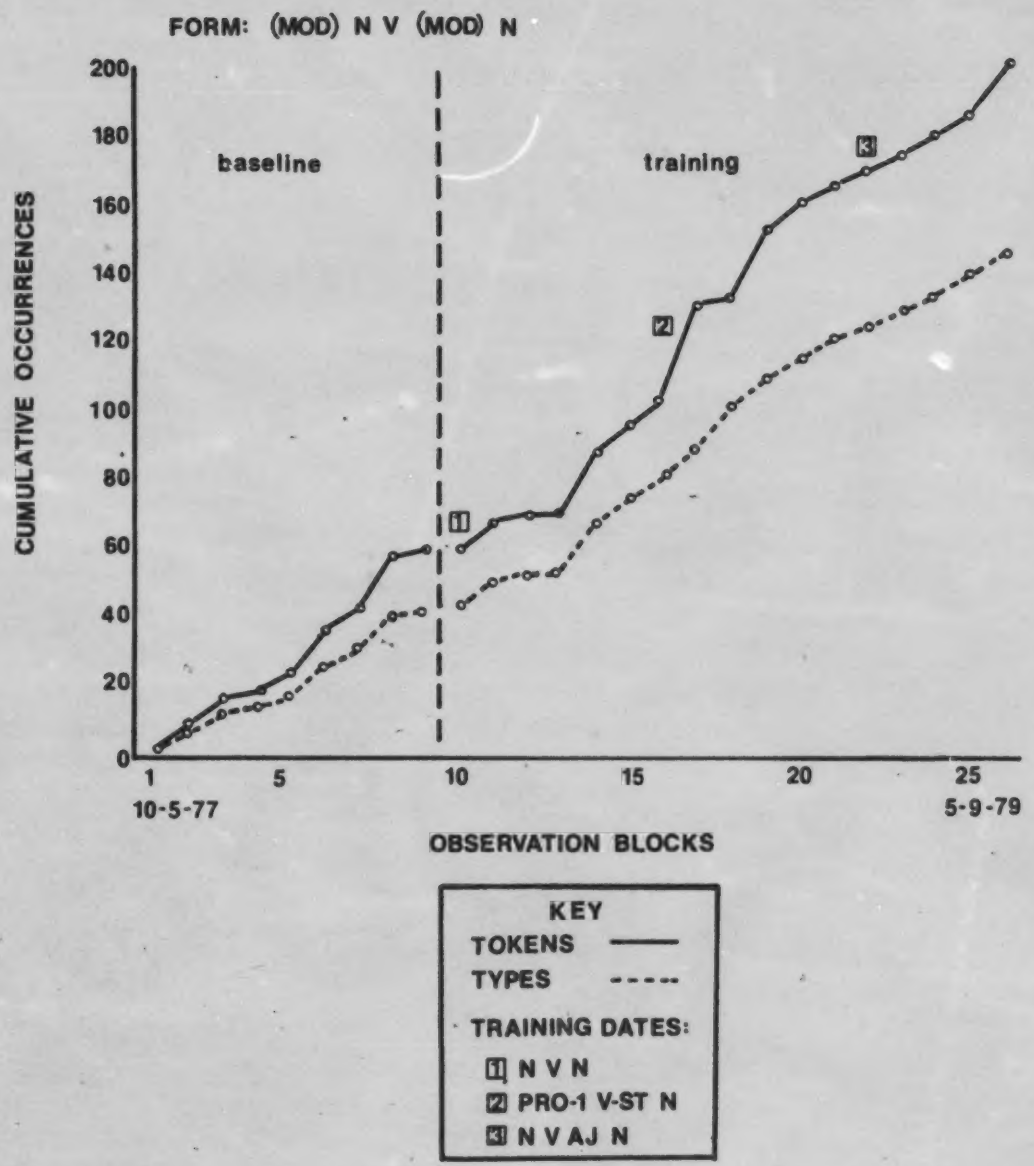


Figure 54

SUBJECT: JC **SITE: LAWR**

FORMS: COMBINED SETTINGS



SUBJECT: JC

Figure 55

SITE: LAWR

FORMS: BY SETTING

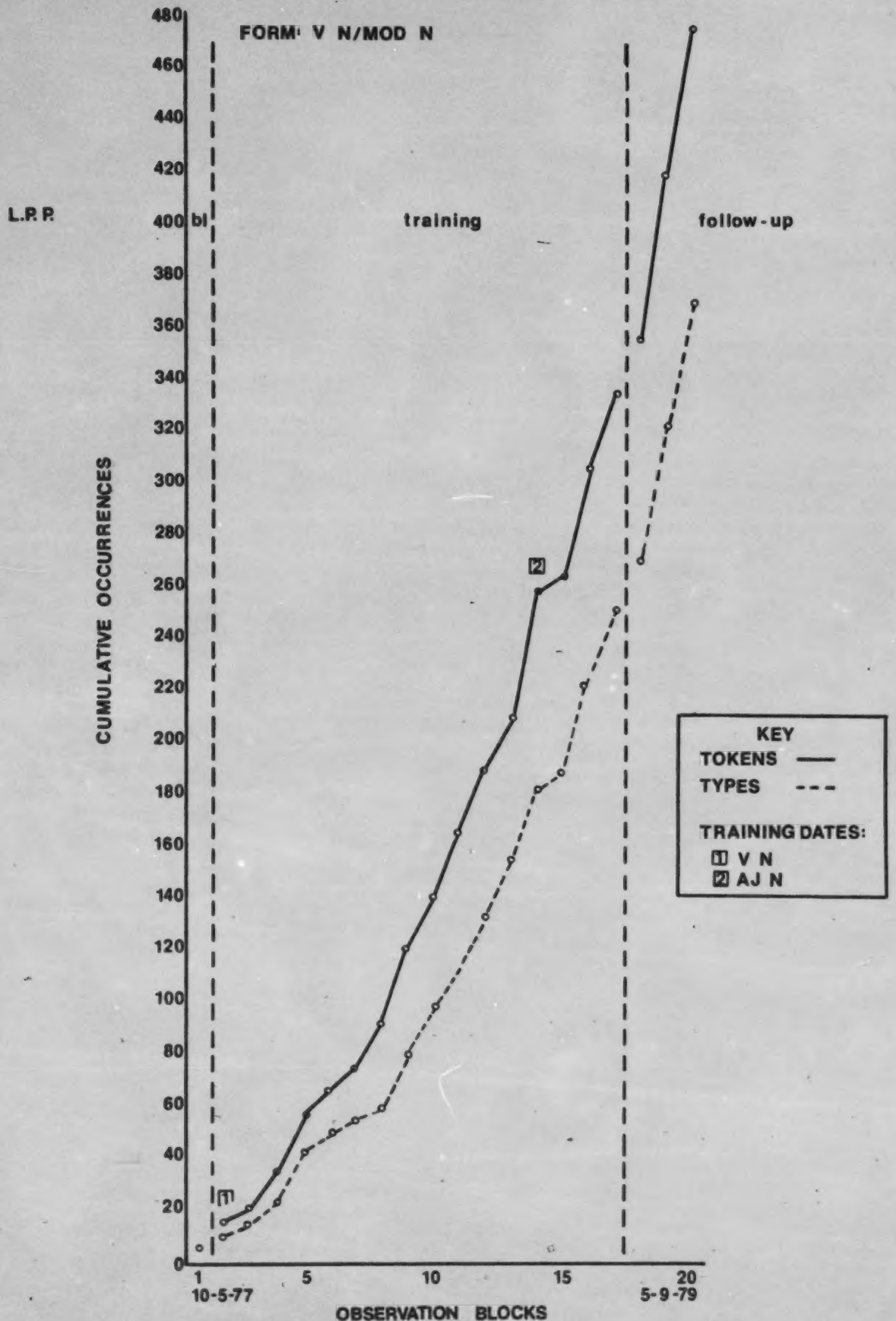


Figure 56

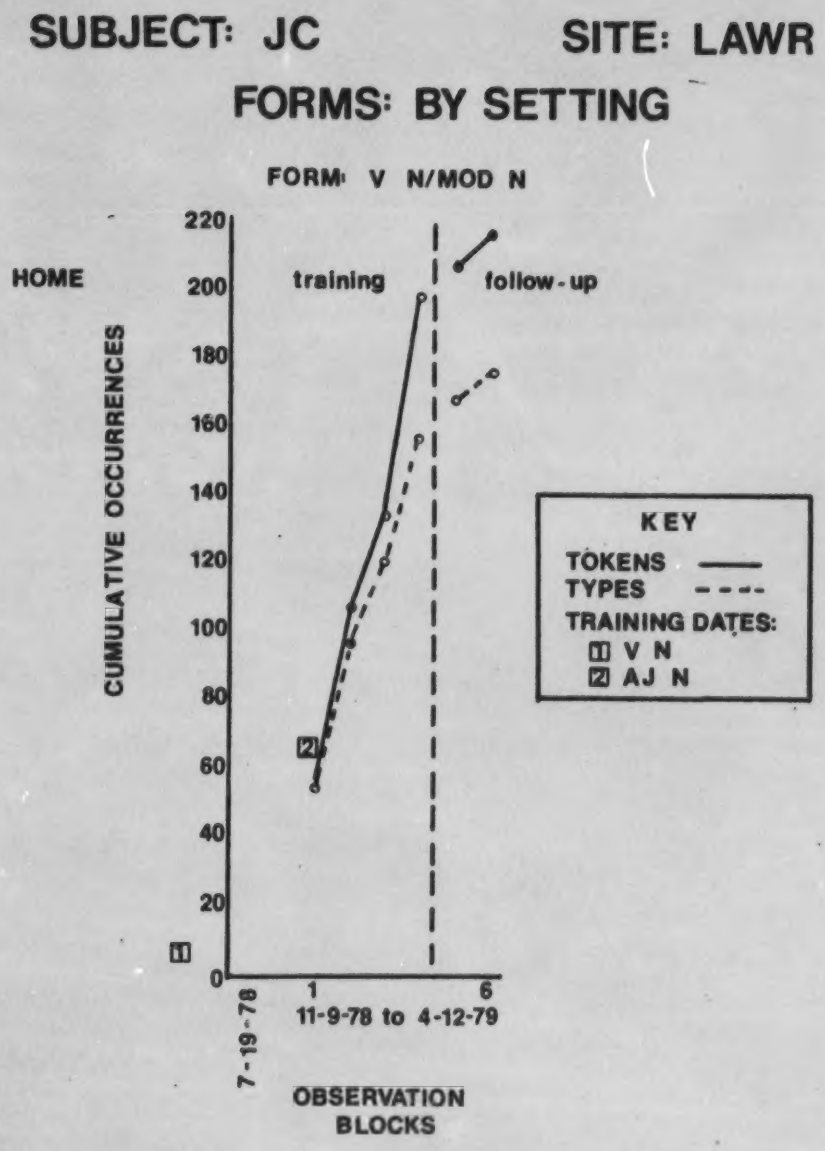
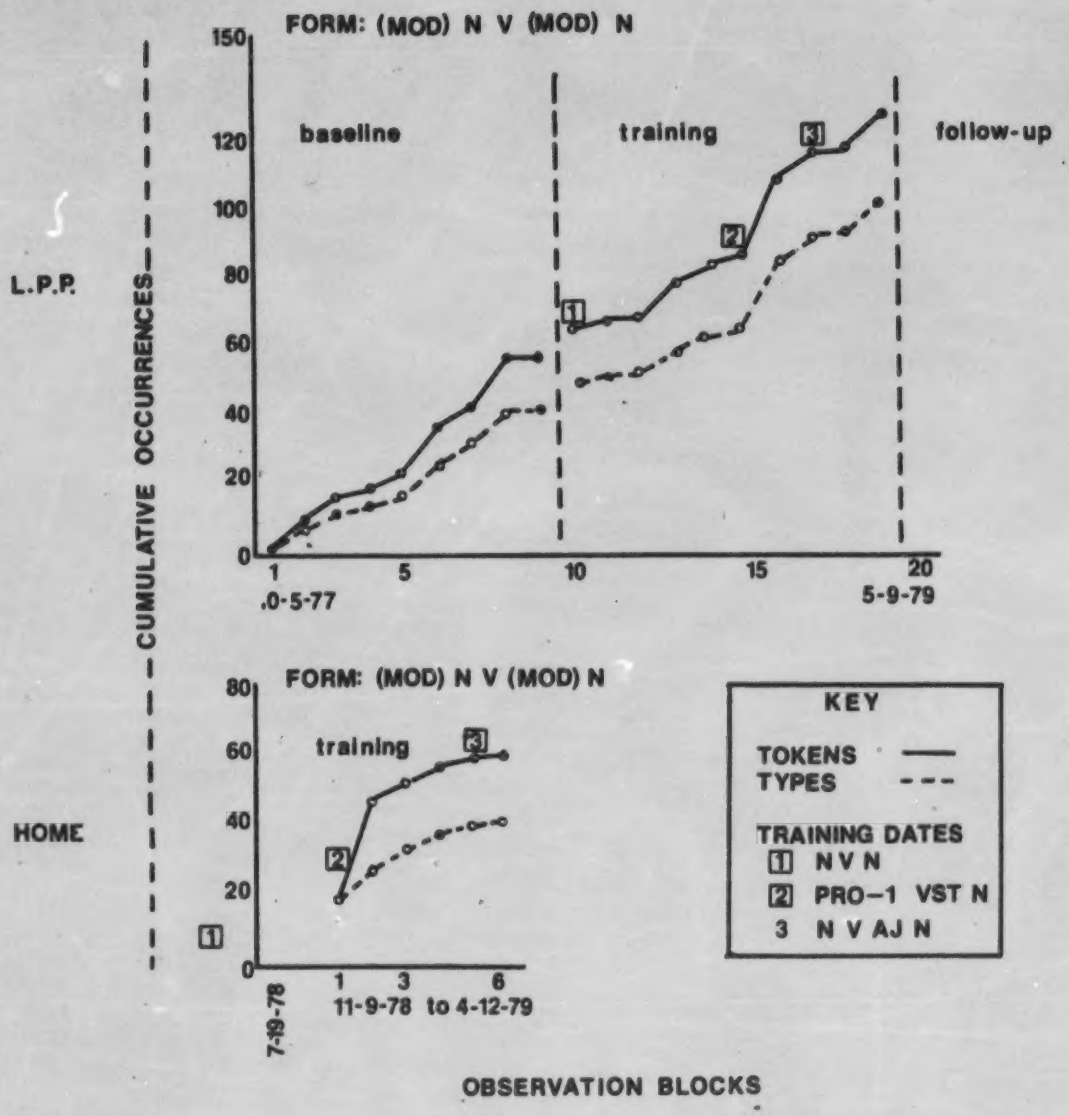

SUBJECT: JC
SITE: LAWR
FORMS: BY SETTING
FORM: V N/MOD N
HOME
training
follow-up
CUMULATIVE OCCURRENCES
220
200
180
160
140
120
100
80
60
40
20
0
KEY
TOKENS
TYPES
TRAINING DATES:
1 V N
2 AJ N
7-19-78
1
6
11-9-78 to 4-12-79
OBSERVATION BLOCKS

Figure 57

SUBJECT: JC SITE: LAWR

FORMS: BY SETTING



Complexity Effects

The growth in J.C.'s language complexity was gradual throughout the first half of the analysis and leveled off during the second half. MLU became less variable during the analysis, improving by approximately 1.0 morpheme to 3.25. Upperbound climbed from 6 to 13 morphemes during the analysis, a major gain. The subject's use of nouns, verbs, modifiers, and function words increased steadily during the analysis (both types and tokens).

Rate Code Effects

Rate observations were taken from September, 1977 through December, 1978. The rate of teacher verbalizations to J.C. remained steady for the period ($\underline{X}$ = 14). His rates of initiations and total verbalizations increased to means of 29 to 40 utterances respectively. His mean percentage of obligatories responded to increased and then maintained at about 70%.

Summary

The assessment test scores and upperbound data indicate J.C.'s linguistic competence generally improved although the other complexity measures did not. The size, diversity, and rate of his vocabulary increased. However, the specific effects of training are uncertain due to his apparent use of target structures before training was initiated.

Subject: J.W. Sex: Male Age: 4.0 to 5.1

Training

J.W. attended LPP from March, 1976, through May, 1977. He was trained on the following structures: Pronoun-Verb (12-1-76, one exemplar); Noun-Verb-Noun (9-27-76 to 11-16-76, 43 exemplars); Pronoun-Verb-Noun (12-6-76, three exemplars); Pronoun-Auxiliary Verb-Progressive Verb-Preposition-Modifier-Noun (3-29-77, one exemplar); Pronoun-Auxiliary Verb-Progressive Verb-Modifier-Noun (3-29-77, six exemplars); Pronoun-Auxiliary Verb-Progressive Verb-Noun (3-29-77, two exemplars). Only Noun-Verb-Noun was trained to criterion.

Assessment

The results of the PPVT, STACL, and Houston (Part III) are listed below:

	PPVT	STACL	Houston
January 1977	M.A. 3-10	90%ile	4 yr. + level
May 1977	M.A. 4-11	50%ile	4 yr. + level

Word Generalization: (not applicable) J.W.'s vocabulary included 817 words.

Structure Generalization

A total of 72 verbatim observations were taken from September, 1976, through May, 1977. The structures trained were collapsed into three general classes. Nominal-Verb, Nominal-Verb-Nominal, and Nominal-Verb-Verb-(Modifier)-Nominal. Nominal-Verb and Nominal-Verb-Verb-(Modifier)-Nominal both occurred in baseline data. No baseline data were available for Nominal-Verb-Nominal, but there were many occurrences during and after training. No training effects were observed. These generalization data are presented in Figure 58.

Complexity Effects

MLU fluctuated between 2.50 and 3.25. Upperbound rose from nine to 11 morphemes with some variability. Other complexity measures were variable, but did not increase. Mean rates of nominals, verbs, modifiers, and function words increased over the observational period.

Rate Effects

A total of 69 rate observations were taken from March, 1976, through May, 1977. J.W.'s rates of total verbalizations and initiations increased in the fall, 1976, then decreased slightly in spring, 1977. The mean percentage of obligatories answered increased from 53% to 65%.

Summary

J.W.'s language did not show significant increases in diversity or complexity. He had a large vocabulary and standardized assessment scores indicated he was nearly normal for his age. No training effects were evident.

Subject: S.Q. Sex: Female Age: 3.5 to 4.3

Training

S.Q. attended LPP from September, 1975, through May, 1976. She was initially trained on nine verbs, nine prepositions, three pronouns, and three adjectives. The following structures were trained: Noun-Verb (10-21-75, exemplars), Verb-Noun (11-3-75, exemplars); Pronoun-Verb-Noun (2-23-76 to 3-1-76, exemplars); Noun-Verb-Noun (11-3-75 to 12-3-75, exemplars); Noun-Verb-Preposition-Noun (3-2-76 to 3-22-76, exemplars); Noun-Verb-Adjective-Noun (3-9-76 to 3-30-76, exemplars). Criterion was reached on all structures except Noun-Verb and Verb-Noun.

Assessments: Data not available.

Figure 58

SUBJECT:JW

SITE: LAWR.

FORMS: COLLAPSED

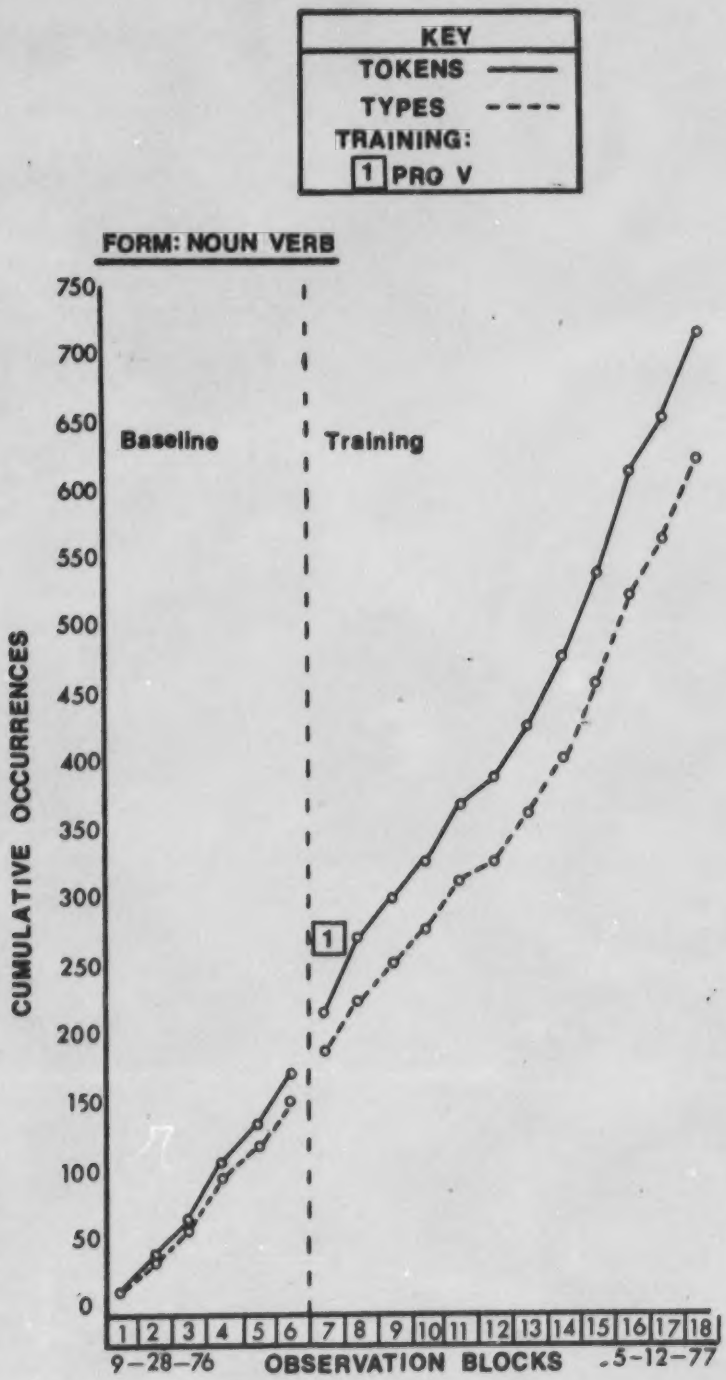
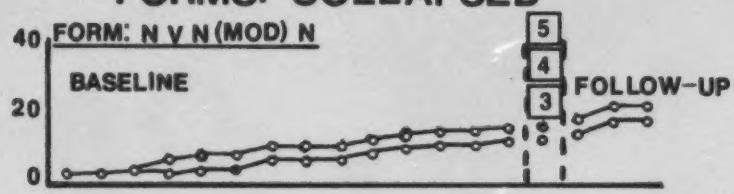


Figure 58a

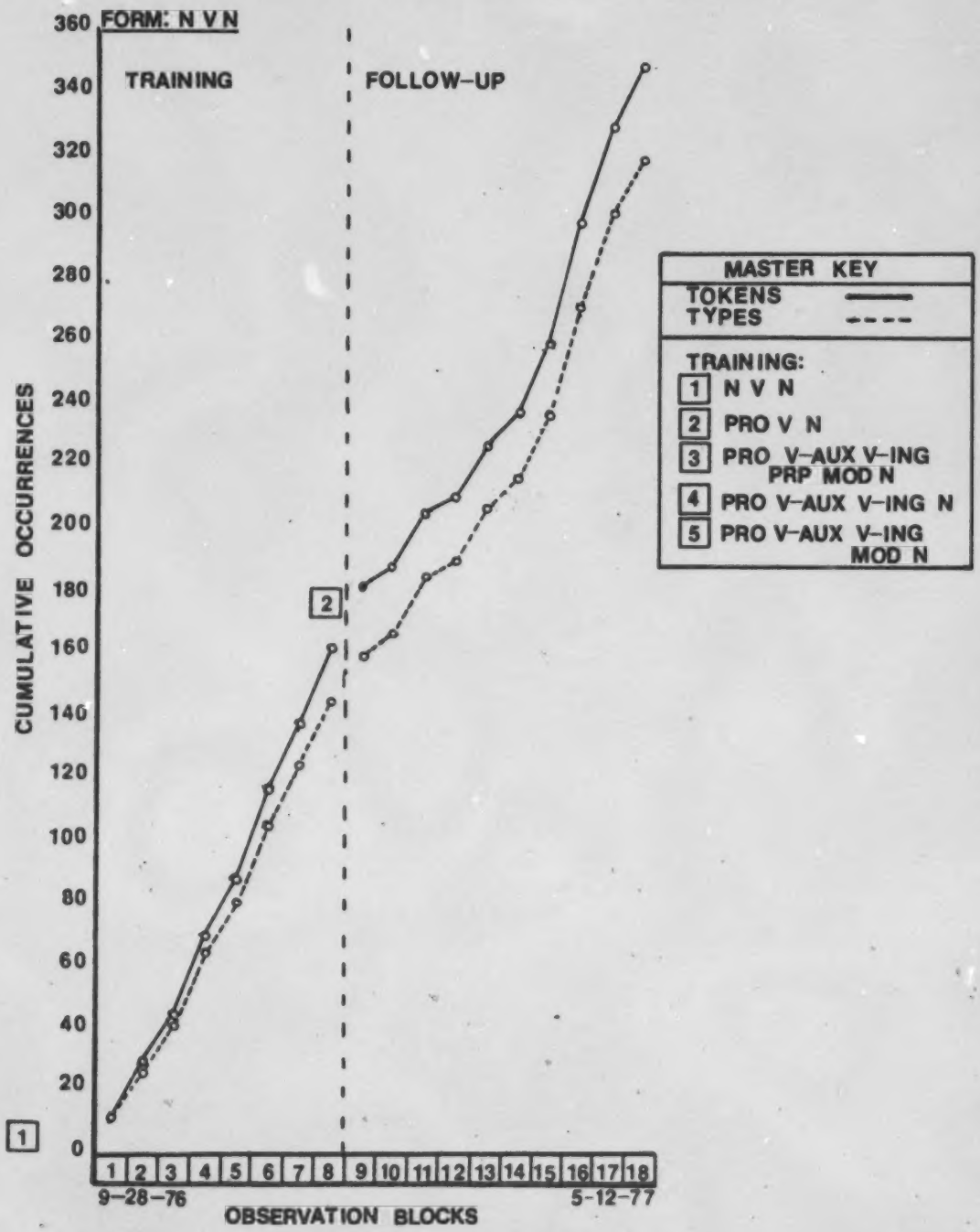
SUBJECT: JW

SITE: LAWR.

FORMS: COLLAPSED



NO OCCURENCE OF THE FORM: (MOD) N V PRP (MOD) N



Word Generalization

Thirty nine verbatim observations were taken at LPP from February, 1976, through May, 1976. The word generalization ratios were:

	One Occasion	Two Occasions
Verbs	4/9 = .44	3/9 = .33
Prepositions	3/9 = .33	3/9 = .33
Pronouns	3/3 = 1.00	3/3 = 1.00
Adjectives	3/3 = 1.00	3/3 = 1.00
TOTAL	13/24 = .54	12/24 = .50

S.Q.'s vocabulary included 432 words.

Structure Generalization

The trained structures were collapsed into three general classes: Nominal-Verb/Verb-Nominal; (modifier) Nominal-Verb-(modifier) Nominal, and (modifier)-Nominal-Verb-Preposition-(modifier)-Nominal. All three forms generalized. Baseline data were insufficient to allow a clear analysis of effects. There was a possible training effect on the form Nomimal-Verb-Preposition-Nominal. These data are shown on Figure 59.

Complexity Effects

MLU rose from 2.15 and leveled off at 3.15. Upper-bound climbed from seven to 10 morphemes and then decreased to seven morphemes again. Most other complexity measures showed little or no change. Nominals per utterance increased substantially from .80 to 1.25. The mean rates of nominals, verbs, modifiers, and function words increased also (both types and tokens).

Rate Effects

Rate observations were taken from March, 1976, through May, 1976. The mean number of child verbalizations per observation was 25. Initiations decreased but the total verbalization rate increased over time. The mean percentage of obligatory situations responded to was 70%.

Summary

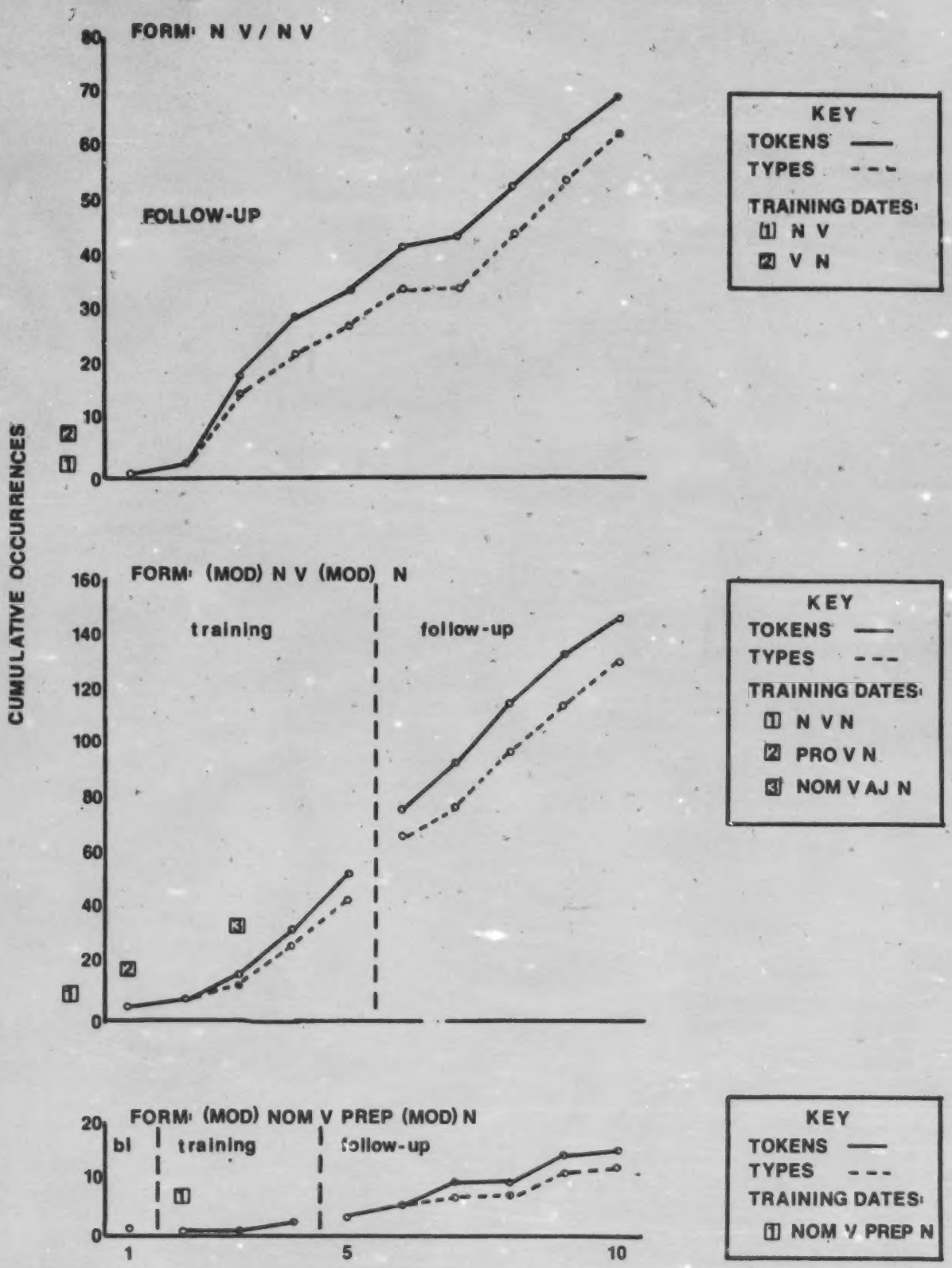
S.Q.'s language improved a little in terms of rate, diversity, and complexity. Training may have effected S.Q.'s use of the form Nominal-Verb-Preposition-Nominal. Other training effects are not clear because baselines were insufficient.

SUBJECT: SQ

Figure 59

SITE: LAWR

COLLAPSED FORMS: SETTINGS COMBINED



Subject: C.U. Sex: Male Age: 2.11 to 3.6

Training

C.U. attended LPP from September, 1978, to May, 1979. It was determined that an incidental language intervention would be more appropriate than training because of C.U.'s excellent receptive language skills. One-word mands were given starting 10-17-78. Two-word mands were given starting 11-27-78. Finally, a fade-out procedure was initiated on 3-5-79. A description of these procedures can be found in the Environmental Intervention section (McQuarter, Warren & Rogers-Warren).

Assessments

The results of the PPVT, STACL, and Houston (Parts I and II) are listed below:

	PPVT	STACL	Houston
September 1978	M.A. 4-7	----	21.2 mo. level (I)
December 1978	M.A. 5-2	97%ile	3 yr. + level (II)
May 1979	M.A. 5-4	97%ile	4 yr + level (II)
September 1979	M.A. 4-9	94%ile	4 yr. + level (II)

Word Generalization: (Not applicable) C.U.'s vocabulary included 447 words.

Structure Generalization

Generalization is not an applicable term in C.U.'s case because of the incidental teaching intervention. The occurrences of the following collapsed forms are presented in Figures 60 and 61: Nominal-Verb/Verb-Nominal/Modifier-Noun; (Modifier)-Nominal-Verb-(Modifier)-Nominal; (Modifier)-Nominal; Nominal-Verb-Preposition-Modifier-Nominal; (Modifier)-Nominal-Verb-Negative-Verb-(Modifier)-Nominal. C.U. was observed 71 times from September, 1978, through May, 1979. His showed remarkable improvement as a result of the incidental teaching procedure.

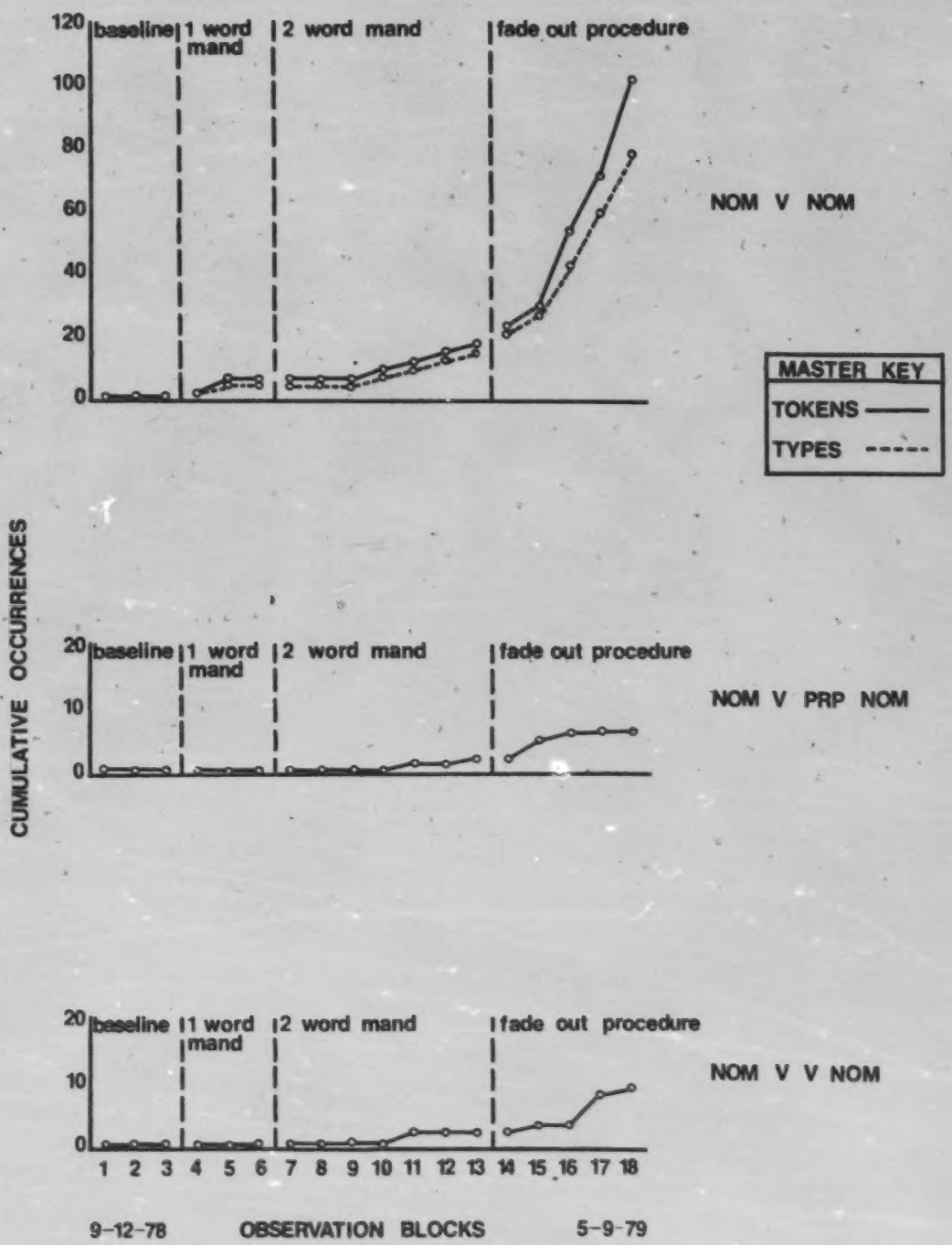
Complexity Effects

MLU increased from 1.0 to 2.5 over the observational period. Upper-bound increased from two morphemes to eight morphemes. Other complexity measures--except function words per utterance, revealed substantial increases. The high proportion of function words per utterance at the beginning of the observational period was apparently an artifact of a very low verbalization rate and low complexity. The rates of nominals, verbs, modifiers, and function words increased over time.

Figure 60

SUBJECT; CU **SITE; LAWR**

FORMS; COLLAPSED

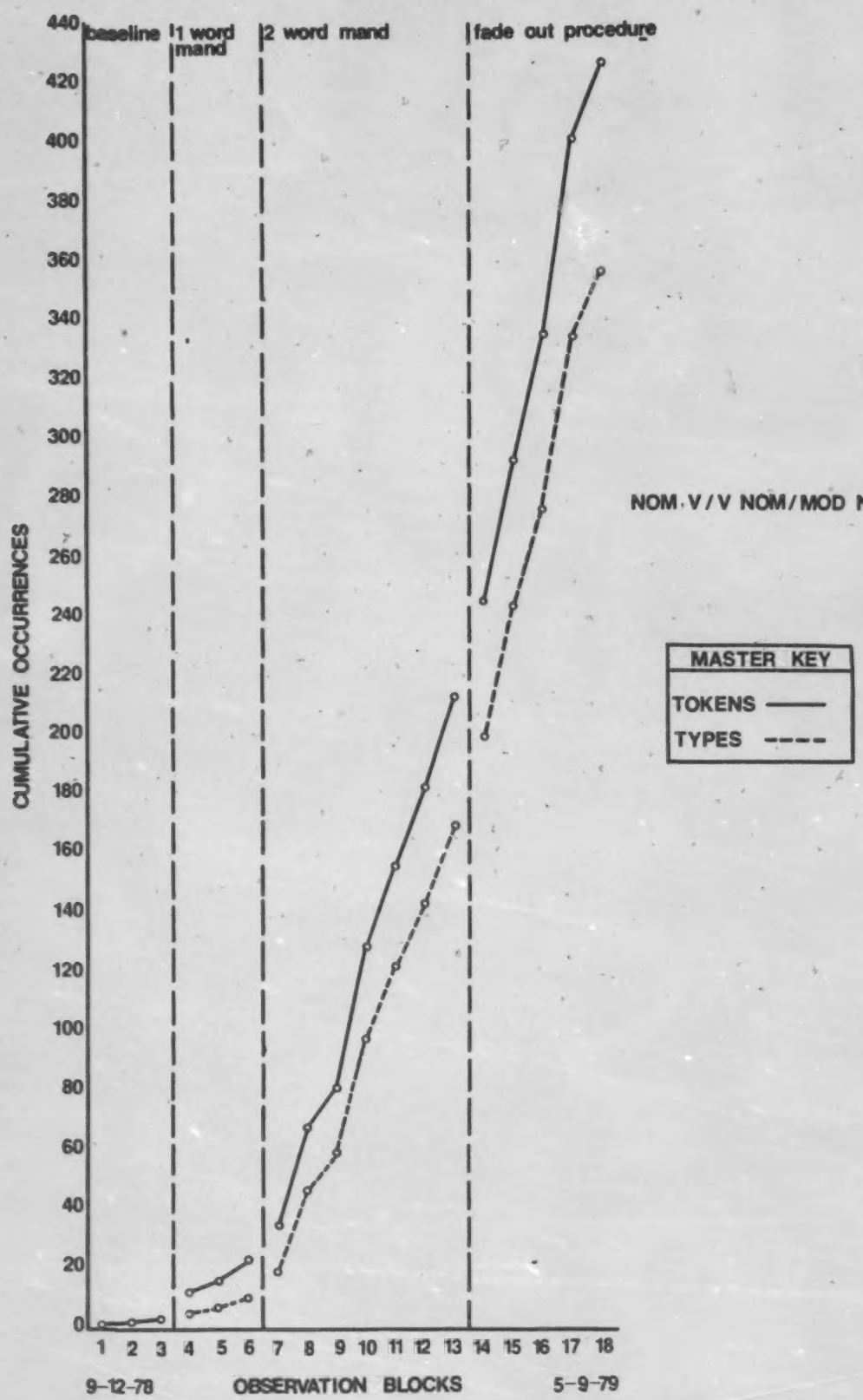


SUBJECT; CU

Figure 61

SITE; LAWR

FORMS; COLLAPSED



Rate Effects

A total of 44 rate observations were taken from September, 1978, through May, 1979. C.U.'s total verbalization rate was effected dramatically by the incidental teaching intervention, increasing from a mean of 10 utterances per observation in the fall semester to 28 utterances per observation in the spring semester. Spontaneous initiations increased also. Teacher verbalizations to C.U. increased somewhat during the spring semester. The percentage of obligatory situations responded to increased from 5% to 60%.

Summary

Standardized tests suggested that C.U. had strong developmental potential. The incidental teaching intervention effected his performance level by increasing his verbalization rate. Overall language complexity improved as a result of mands requiring more complex structures.

Subject: D.A. Sex: Male Age: 2.8 to 5.3

Training

D.A. attended LPP from September, 1976, through May, 1979. He was trained initially on 29 nouns (2-7-77 to 4-28-77, 25 sessions) and 20 verbs (10-12-77 to 11-10-77, 14 sessions). He was then trained on the following forms: Verb-Noun (11-29-77 to 12-5-77, 10 exemplars); Color Adjective-Noun (2-2-78 to 4-47-8, 10 exemplars); Noun-Verb-Noun (4-5-78 to 9-27-78, 30 exemplars); Noun-Verb-Color Adjective-Noun (9-28-78 to 10-25-78, 20 exemplars); Noun-Verb-Preposition-Noun (10-30-78 to 3-20-79, 30 exemplars); Noun-Verb-Preposition-Noun (3-27-79 to 4-23-79, 20 exemplars). D.A. reached criterion on all forms except Noun-Verb-Preposition-Noun. The mean time spent training each form was 15.33 sessions.

Assessments

The results of the PPVT, STACL and Houston (Parts I & II), are listed below:

	PPVT	STACL	Houston
January 1977	M.A. 1-10	-----	26 mo. level (I)
May 1977	M.A. 2-2	Unscorable	27 mo. level (I)
September 1977	M.A. 2-11	7%ile	-3 yr. level (II)
December 1977	M.A. 2-8	7%ile	3 yr. + level (II)
May 1978	M.A. 3-3	17%ile	-4 yr. level (II)
September 1978	M.A. 3-4	74%ile	-4 yr. level (II)
December 1978	M.A. 3-7	74%ile	4 yr. level (II)
May 1979	M.A. 4-4	12%ile	4 yr. + level (II)

Word Generalization

D.A. was observed 167 times (LPP-144;/Other preschool-23). The word generalization ratios were:

	One Occasion	Two Occasions	Two Settings
Nominals	16/25 = .64	12/25 = .48	4/25 = .16
Verbs	13/15 = .87	8/15 = .53	1/15 = .07
TOTAL	29/40 = .73	20/40 = .50	5/20 = .13

D.A.'s vocabulary included 959 words.

Structure Generalization

The structures trained were collapsed into two general classes for analysis: Verb-Nominal/Modifier-Nominal and Nominal-Verb-Nominal. The Noun-Verb-Preposition-Noun did not occur in the data. Both forms occurred during baseline. These data are shown in Figures 62-66.

Complexity Effects

MLU increased from 1.20 to 2.20, a small increase for a period of more than 2 years. Upperbound increased from three to eight morphemes. Nominals per utterance and verbs per utterance increased. Mean rates of nominals, verbs, modifiers and function words show large increases.

Rate Effects

One hundred twenty nine rate observations were taken from September, 1976, through April, 1978. D.A.'s total verbalizations and initiations increased over the entire period to very high rates. The percentage of obligatory situations responded to increased from 50% to a high of 80%.

Summary

D.A. had a very high verbalization rate. His consistent use of less complex structures masked increases in complexity, which occurred at lower rates as evidenced by upperbound data. Assessment scores also indicated improvement. Although generalized training effects were not strong, the structure generalization graphs revealed an increasing use of more complex forms.

Figure 62

FORMS: settings combined

SUBJECT: DA

SITE: LAWR.

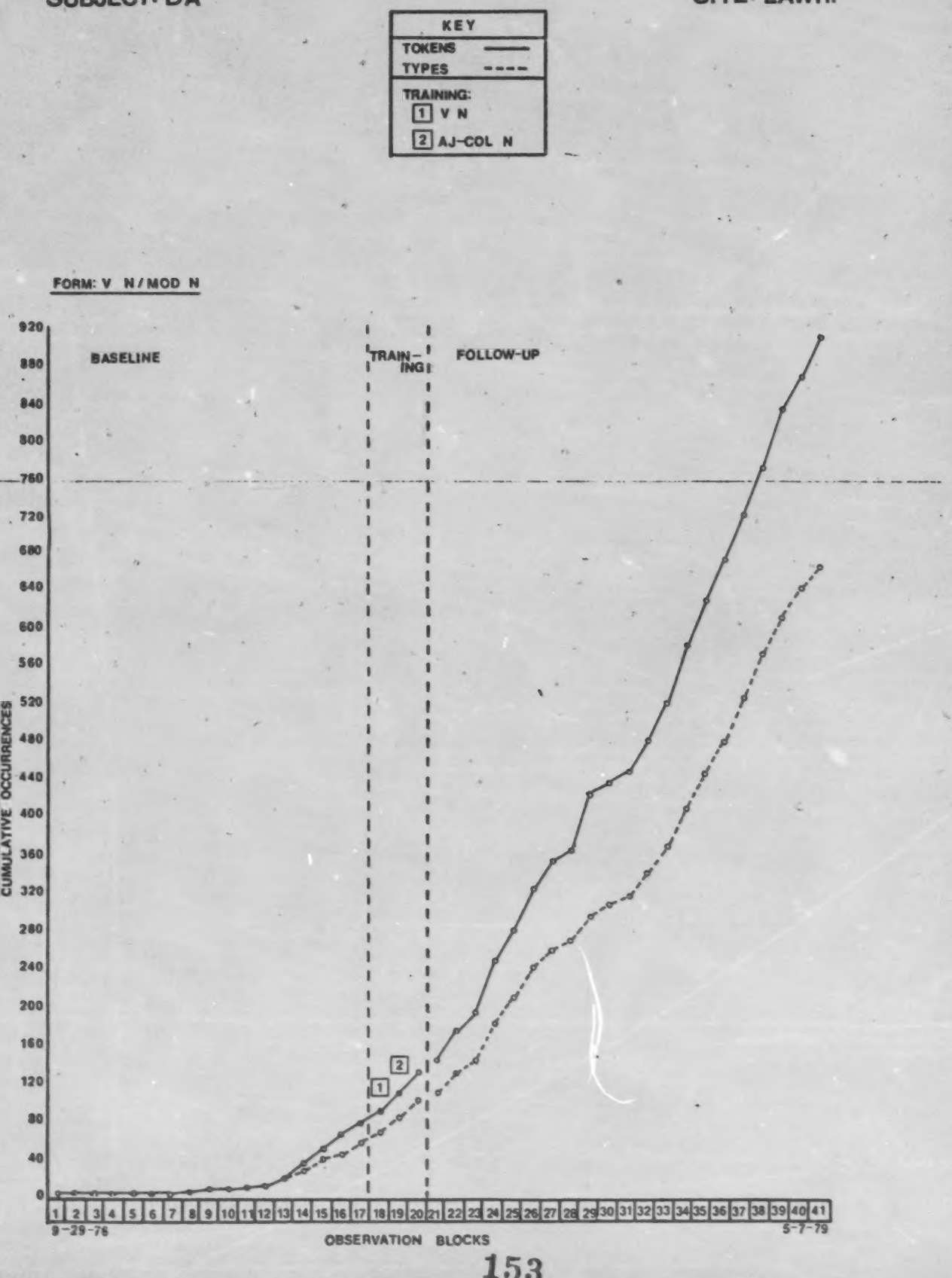
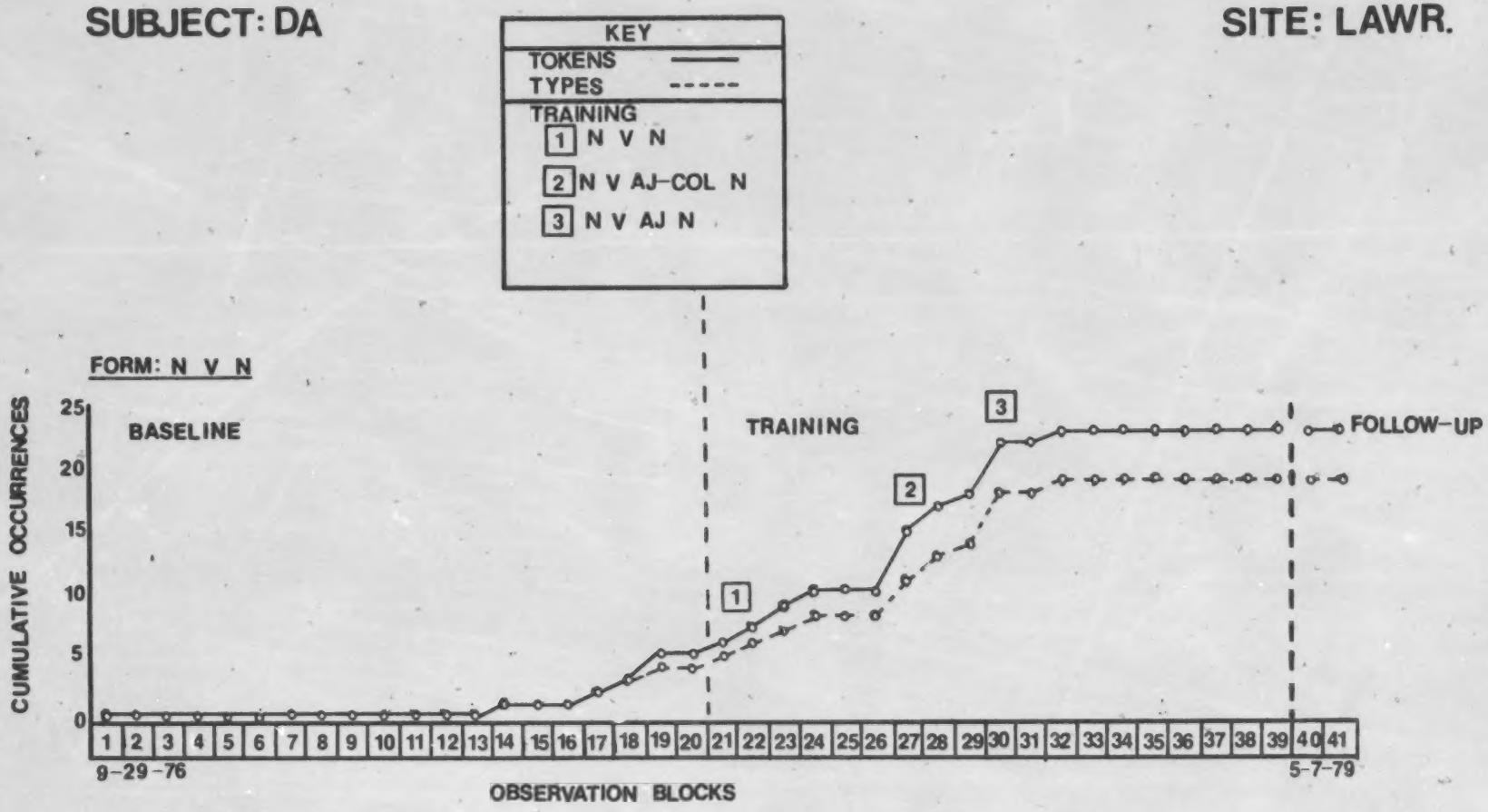


Figure 63

FORMS: SETTINGS COMBINED



FORMS: BY SETTING

Figure 64

SUBJECT: DA

SITE: LAWR.

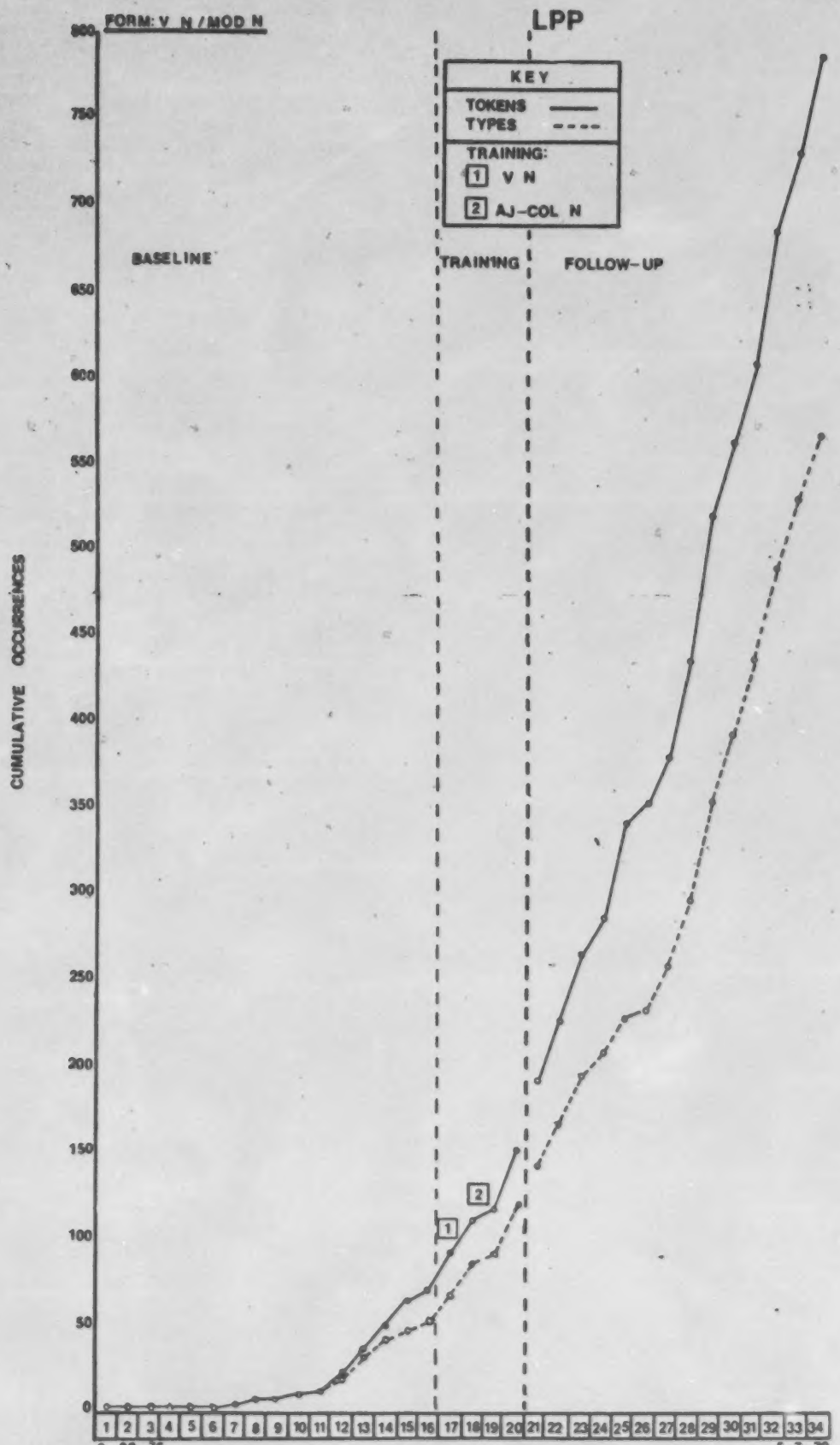


Figure 65

FORMS: BY SETTING

L P P

SUBJECT: DA **SITE: LAWR.**

KEY	
TOKENS	———
TYPES	- - - - -
TRAINING	
1	N V N
2	N V AJ-COL N
3	N V AJ N

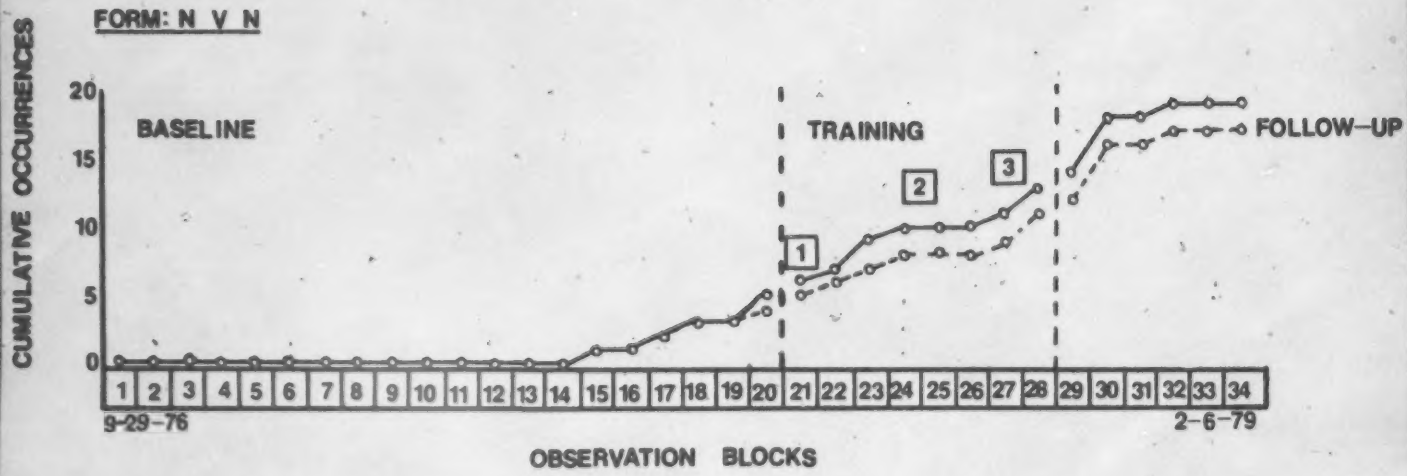
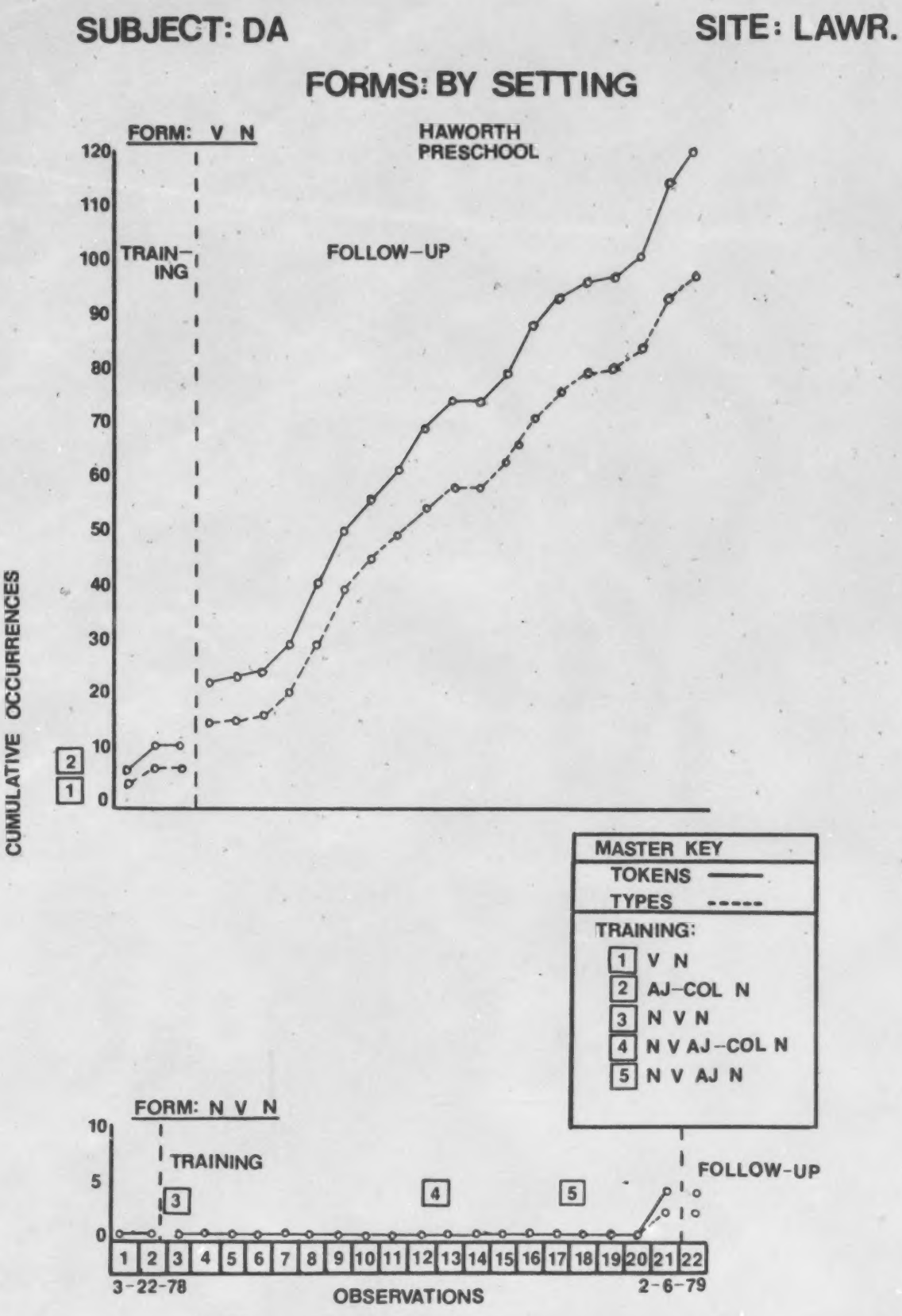


Figure 66


SUBJECT: DA
SITE: LAWR.
FORMS: BY SETTING
FORM: V N
HAWORTH PRESCHOOL
TRAIN-ING
FOLLOW-UP
CUMULATIVE OCCURRENCES
120
110
100
90
80
70
60
50
40
30
20
10
0
2
1
MASTER KEY
TOKENS
TYPES
TRAINING:
1 V N
2 AJ-COL N
3 N V N
4 N V AJ-COL N
5 N V AJ N
FORM: N V N
TRAINING
FOLLOW-UP
10
5
0
3
4
5
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
3-22-78
OBSERVATIONS
2-6-79

Subject: L.C. Sex: Female Age: 3.0 to 4.3

Training

L.C. attended LPP from March, 1978, through May, 1979. She was trained on 30 nouns from 6-23-78 to 10-4-78 (17 sessions) and 20 verbs from 10-4-78 to 11-2-78 (13 sessions). The following structures were trained: Verb/Noun (11-6-78 to 11-22-89, 20 exemplars); Color-Adjective-Noun (11-28-78 to 2-14-79, 20 exemplars); Adjective-Noun (2-26-79 to 3-29-79, 18 exemplars); Pronoun-State Verb-Noun (3-27-79 to 4-26-79, random). All structures were trained to criterion except Pronoun-State Verb-Noun, which was still being trained when data collection ended. The mean time spent training each form was 14.25 sessions. In addition to training, L.C. was a subject in an incidental language training study (one word mands, 11-20-78; two word mands, 2-12-79; fade out, 4-12-79). Procedures for this study are in the Environmental Intervention section (McQuarter, Warren & Rogers-Warren).

Assessments

The results of the PPVT, STACL and Houston (Parts I and II) are presented below:

	PPVT	STACL	Houston
December 1977	M.A. 2-3	-----	24 mo. level (I)
May 1978	M.A. 2-11	-----	26.6 mo. level (I)
September 1978	M.A. 3-3	-----	-3 yr. level (II)
December 1978	M.A. 3-9	49%ile	3 yr. + level (II)
May 1979	M.A. 3-10	37%ile	4 yr. level (II)

Word Generalization

L.C. was observed 106 times (LPP - 84; Home - 22).

The word generalization ratios are presented below:

	One Occasion	Two Occasions	Two Settings
Nouns	25/29 = .86	21/29 = .72	15/29 = .52
Verbs	14/20 = .70	6/20 = .30	3/20 - .15
TOTAL	39/49 = .80	27/49 = .55	18/49 = .37

L.C.'s vocabulary included 710 words.

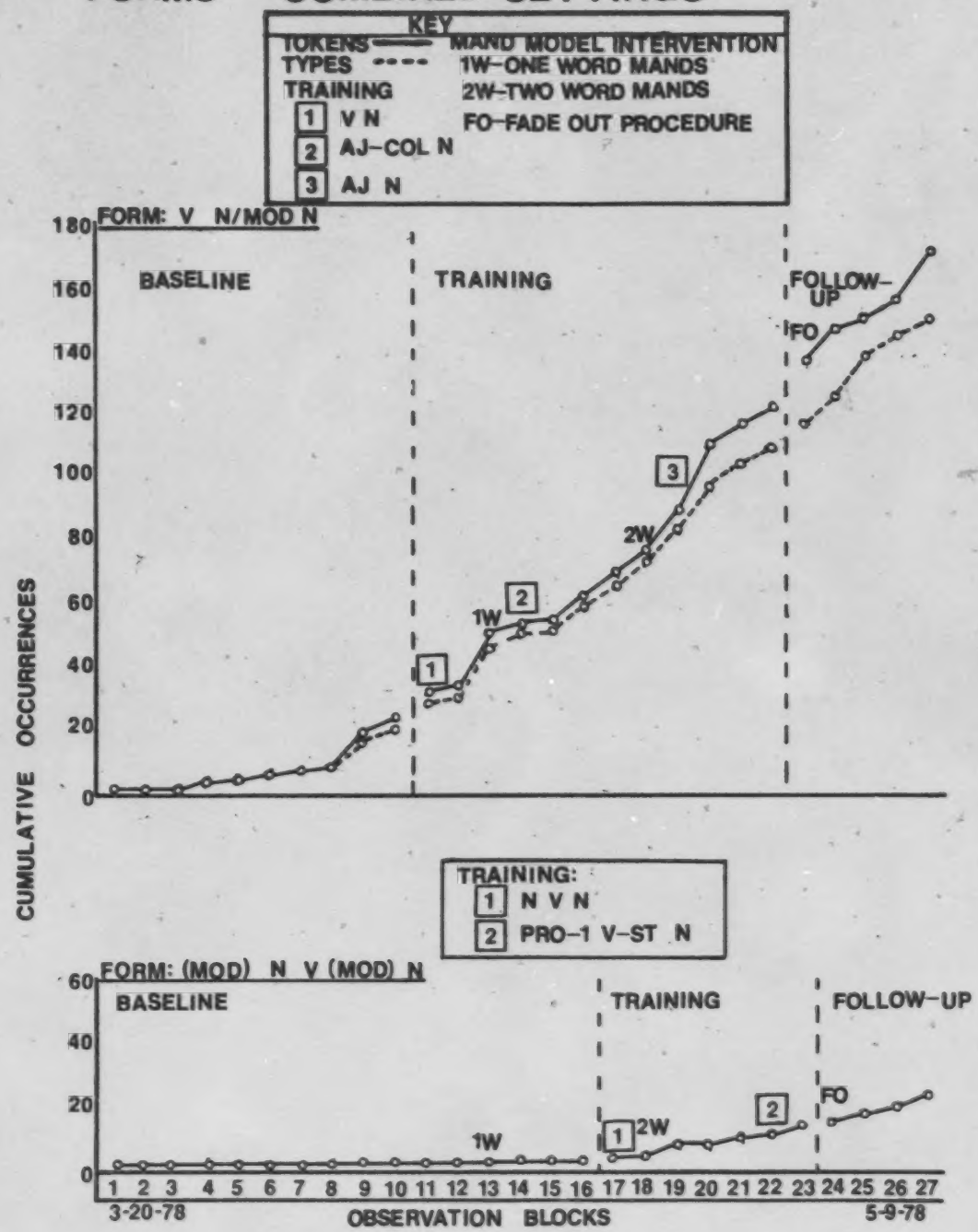
Structure Generalization

The structures trained were collapsed into two general classes for analysis: Verb-Nominal/Modifier-Nominals and (Modifier)-Nominal-Verb-(Modifier)-Nominal (see Figures 67 and 68). Slight training effects are noticeable for Noun-Verb-Noun although it is not clear whether this effect is from training or the incidental training intervention.

Figure 67

SUBJECT:LC SITE:LAWR.

FORMS: COMBINED SETTINGS



SUBJECT: LC

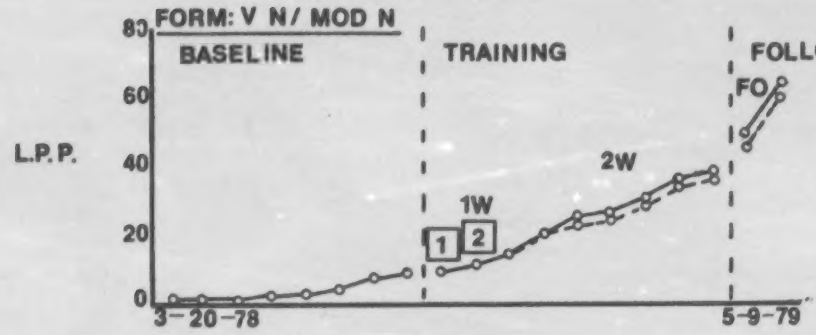
Figure 68

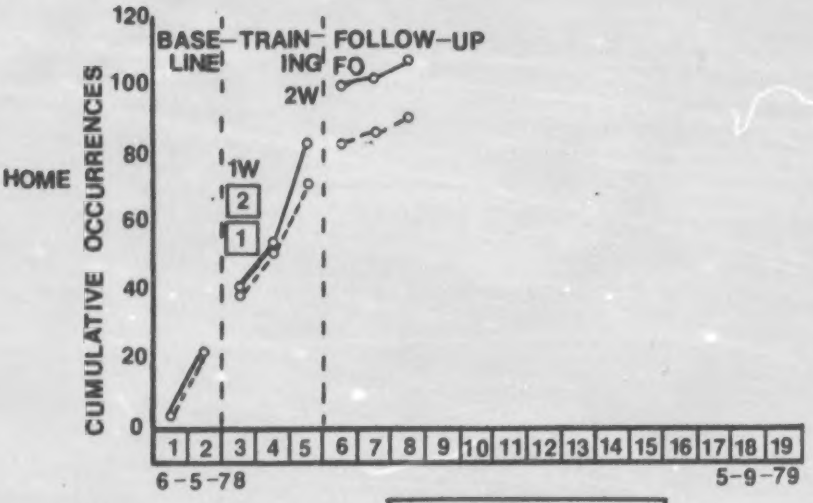
SITE: LAWR

FORMS: BY SETTING

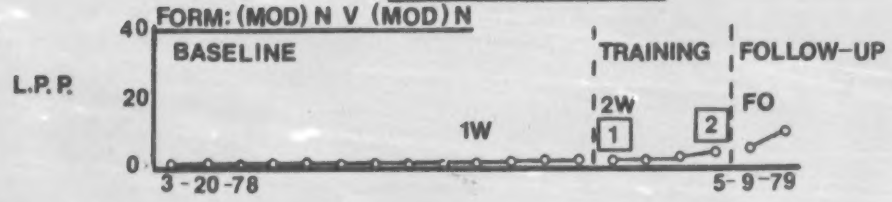
TOKENS ——
TYPES - - - -
TRAINING:
1 V N
2 AJ-COL N
3 AJ N

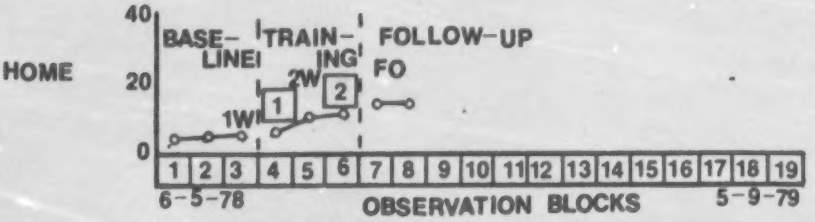
MAND MODEL INTERVENTION
1W-ONE WORD MANDS
2W-TWO WORD MANDS
FO-FADE OUT PROCEDURE





TRAINING:
1 N V N
2 PRO-1 V-ST N





Complexity Effects

MLU climbed from 1.0 to 2.0 over the observational period. Upperbound rose sharply from two to eight morphemes. Other measures revealed some improvement especially nominals per utterance. There were large increases in the mean rate of nominals, verbs, modifiers, and function words.

Rate Effects

A total of 44 rate observations were taken. L.C.'s total verbalization and initiation rates increased concurrent with the incidental teaching intervention. The percentage of obligatory situations responded to increased to 70% during the spring, 1979, semester.

Summary

The rate, complexity, and diversity of L.C.'s language increased. Training effects were not clear. The conjunction of training with incidental teaching intervention appears to have been conducive to L.C.'s development. The incidental teaching intervention strongly affected L.C.'s verbalization rate.

LPP Discussion

Data for 12 children enrolled in Language Project Preschool are reported in the preceding section and summarized in the table below.

Insert Table 16 about here

Clear generalization from training on at least one major class (combined forms) of trained structures was observed for six subjects. Seven subjects were trained on specific vocabulary and all except one subject showed moderate to high ratios of generalization to naturalistic settings. Generally, subjects generalized simple forms more rapidly and frequently than complex ones. Increasing numbers of exemplars for major classes, either by training more specific examples of the component structures of by training more component structures, were correlated with higher levels of generalization.

Five subjects demonstrated acquisition of the trained class but the source of acquisition was unclear. In some instances, no baseline data were available because the child was enrolled in training before the research project began. Because baseline data were sometimes not analyzed immediately (the computer program for tracking generalization was not completed

Table 16

Summary of Results for LPP Subjects

Subject	Structures	Length of Obs	Generalization	Rate[1]	Complexity[2]	Assessments	Comments
D.A.	VN/AJ-N NV (MOD) N Vocabulary	20 mos.	Acquired Generalized Generalized	Increased by about 50%	MLU 1.2→ 2.2 UB 3→8	PPVT +2.6 yr STACL$^{\Delta}$ +12% Houston + 2 yr Vocabulary - 959 words	
M.J.	(MOD) NV (MOD) N (N) (MOD) N V PREP (MOD) N Vocabulary	21 mos.	Generalized Generalized Generalized	Tripled	MLU 1.4→4.0 UB 5→17	PPVT +2.3 yr. STACL +24%* Houston +2 yr* Vocabulary - 871 words	
D.N.	NV / MOD N NVN NV PREP N NVVN	20 mos.	Acquired Acquired Acquired Acquired	Tripled	MLU 1.88→3.18 UB 8→12	PPVT +5.7 yr* STACL$^{\Delta}$ +44%* Houston +1 yr* Vocabulary - 555 words	
J.W.	NV (MOD) N MOD NV PREP (MOD) N	9 mos.	Acquired Acquired	Slight Decrease	MLU 2.65→2.94 No change (9 morphemes)	PPVT +1.1 yr STACL - 40% Houston - No Change Vocabulary - 817 words	Near age level before and after enrollment at LPP
J.C.	(MOD) N V (MOD) N	21 mos.	Acquired	Increased by 30%	MLU 2.18→3.34 UB 2→10	PPVT + 2.1 yr* STACL +48% Houston +2 yr* Vocabulary - 817 words	
L.C.	NV / MOD N	14 mos.	Generalized	Increased to level appropriate for age	MLU 2.58→2.63 UB 8→13	PPVT +1.7 yr STACL + 37% Houston +2 yr Vocabulary - 710 words	

Table 16 (Continued)

Subject	Structure	Length of Obs	Generalization	Rate[1]	Complexity[2]	Assessments	Comments
W.A.	MOD N/NV NVN NV PREP N	16 mos.	Acquired Acquired No Effects	No changes; initial rates were appropriate	MLU 2.16→2.20 UB 8→6	PPVT +11 mos. STACL +36%* Houston +1 yr* Vocabulary - 439 words	
C.Z.	VN Vocabulary	9 mos.	Generalized Generalized	Moderate increases	MLU 2.34→2.69 UB 7→10	PPVT$^{\Delta}$ +2.10 yr Houston$^{\Delta}$ +3 yr. Vocabulary - 283 words	Hearing impaire
C.U.	NV VN MOD N/V NVN	9 mos.	Main effects: high rates for all structures	Increased to age appropriate levels	MLU 1.02→2.55 UB 2→10	PPVT +2 mos* STACL 94%* Houston +2+yr* Vocabulary - 447 words	Rate increased via mand/model procedure
J.I.	NV VN MOD N NVN	11 mos.	Main effects: moderate rates for all structures	Increased but still low for age	MLU 2.58→2.63 UB 8→13	PPVT +2.9 yr* STACL$^{\Delta}$ 61% Houston$^{\Delta}$ +4+ yr Vocabulary - 626 words	Rate increased via mand/model procedure
K.S.	NV/VN MOD N (MOD) NV (MOD) N	11 mos.	Generalized No Effects Generalized	Doubled	MLU 1.49→2.6 UB 6→8	PPVT +9 mos STACL +45% Houston +6+ mos Vocabulary - 330 words	
D.K.	NVN Vocabulary	3 mos.	No Effects No Effects	No change, initial rate moderate	MLU 2.51→2.95 UB 6→11	No Assessment Data Vocabulary - 241 words	Left program unexpectedly

Table 16 continued

Subject	Structure	Length of Obs	Generalization	Rate[1]	Complexity[2]	Assessments	Comments
S.Q.	NV/VN N/P V PREP N/P Vocabulary	3 mos.	Acquired Generalized Generalized	Increased to age appropriate levels	MLU 2.49→3.0 UB No change (8 morphemes)	No Assessment Data	In training when project began

[1]Rate measures were calculated by comparing the average rate during the first five observations of a given subject with the average rate during the last five observations for that subject. Rate was calculated as number of utterances per 15-minute sample.

[2]Complexity measures were calculated by comparing MLU (Mean Length of Utterance in morphemes) and UB (upperbound or longest utterances in morphemes) during the first five observations for a given subject with the MLU and UB during the last five observations for that subject.

*Score was at age level on the last assessment using this test.

△Only one score on this test was available, usually because child did not reach basal level on first administration of test.

until several months after the observations began), some children were trained on structures that were already in their spontaneous repertoire. It should be noted, however, that training occurred only if the child failed the pre-test for a particular step of the program. A child may have had a few examples of a particular grammatical structure that were used in natural settings, but not have sufficient skill to produce appropriate examples of the structure during a testing situation. In many cases, the emergence of one or two examples of a syntactic structure in the child's general repertoire was considered to be a good indication that he/she was ready to learn additional examples of the structure. A non-zero or low rate baseline was not considered sufficient and training on the structure was instituted whenever the child failed the pretest.

Three subjects (included in the discussions above) generalized one or more forms and acquired one or more forms.

Three subjects were targeted in an intervention designed to increase their rates of one and two word utterances. One of these subjects received language training and the intervention served to facilitate generalization. The other two subjects were not formally trained. Their acquisition of specific forms was tracked and the results showed that the intervention increased rate of acquisition of new vocabulary and grammatical forms.

Other subjects also showed significant increases in rates of interaction, initiations, and responsiveness in obligatory verbal interactions. Only one child did not increase his rate of verbalization and this child's baseline rate had been comparable to rates observed in normal children.

Complexity increased over time for most subjects, although no subjects showed dramatic effects. MLU was the most sensitive measure of complexity, however, changes in MLU were typically moderate. Vocabulary size increased for all subject and accelerated acquisition of vocabulary frequently coincided with increases in overall rates of verbalization.

Most subjects showed significant gains on standardized assessments. Seven of the 12 children were scoring near age level on one or more of the tests at the conclusion of the generalization observations. All three tests typically indicated the direction of change (gains or losses by the subject) but amount of change indicated by each was variable.

In general, the LPP children displayed moderate generalization, some acquisition of language that may have been the result of training or of verbal interactions in the natural environment, and consistent gains in both rate and complexity of their utterances. These results provide a strong case for the overall positive effects of training, but are difficult to interpret in terms of direct generalization from training. LPP children were the least developmentally delayed population studied and had moderate rates of acquisition of new skills from typical environmental interaction. Although such acquisition facilitates development of language, it prevents a clean analysis of training effects.

Because language delayed children such as the LPP subjects do demonstrate a natural acquisition level, it might be most productive to focus on communication and social interaction skills that are necessary for language display. Interventions to increase rate resulted consistently in increases in complexity of child utterances (see studies reported in the Environmental Intervention section). A first step in evaluating a child's language and determining a training strategy might be to intervene to increase rate of verbalization prior to initiating individualized grammar training. In some instances, with children of similar abilities, such an intervention may be sufficient to increase acquisition from natural interactions.

Parsons Results

Generalization data were collected in an academic setting, a freeplay setting and, in some cases, a dining hall setting. Eight subjects were seen for training on a daily basis for half-hour sessions. Generalization observations occurred an average of four times a week in each setting. If sequential modification or initial training was carried out in an originally specified generalization setting, data from that setting were not included as generalization data.

Specific program changes were made after analyzing initial generalization data. These changes included:

1. Increasing the number of vocabulary exemplars, (20 to 80 words or combinations are trained).
2. Increasing the number of syntactic exemplars
3. Increasing the number of pragmatic exemplars
4. Increasing the maintenance period after the acquisition criterion was met
5. Increasing and varying the stimulus conditions as training progresses
6. Using actual objects (not photographs) for programming

Results for each subject are described below.

Subject: K.M. Sex: Male Age: 14.4

Training

K.M. received manual sign training on the following structures: Action Verb; (State) Verb-Noun; (Action) Verb-Noun; (Pro)-(State) Verb-Noun; (Pro)-Noun-Verb-Noun (did not reach criterion).

K.M. acquired the trained behaviors fairly rapidly and demonstrated structural generalization to untrained combinations. He received training across an 18-month period.

Assessments

Increases in pre-posttest scores on the PPVT and Houston standardized tests were 1.3 years and 6 months respectively. These changes indicate growth in the areas of vocabulary acquisition and receptive and expressive language.

Word Acquisition

K.M. did not begin displaying any new words until three weeks after training was initiated. Increases in vocabulary were apparent prior to meeting training criterion. Total vocabulary for K.M. was 222 words.

Structural Generalization

K.M. showed moderate generalization across all trained structures as shown in Figures 69-71. Basic Noun-Verb-Noun structures were used at comparable rates across both freeplay and academics. K.M. demonstrated the greatest generalization after training criterion had been met. Once K.M. acquired a higher-level behavior, generalization of components of that behavior decreased. Generalization to the dining hall setting occurred only after a sequential modification procedure was initiated during lunch.

Complexity Effects

MLU increased, but not systematically, and varied from 1.00 to 2.40 (which exceeded a training MLU of 2.14). Longest utterances varied from one to four words. Twenty-four percent of all Noun-Verb-Noun utterances were first occurrences.

Rate Effects

Probe rate data indicated wide differences between K.M.'s rates of verbalizations in the academic and the freeplay settings; however, structural generalization data reflected this difference only in structures containing state verbs.

Summary

K.M. displayed moderate generalization with increases in vocabulary acquisition preceding increases in structural generalization. Structural generalization occurred after training criterion was met. K.M. showed gains in standardized tests measuring vocabulary acquisition and global language development.

Subject: W.P. Sex: Female Age: 15.7

Training

W.P. was trained to use manual signs. W.P. received training on single word signs (nouns and verbs) prior to being included as a subject. She received training and met acquisition criterion on the following linguistic structures: Verb-Noun/Verb-Pronoun; Noun-Verb/Pronoun-Verb; Noun-Verb-Noun/Pronoun-Verb-Pronoun. W.P. was also trained on fingerspelling, vocal imitation, and sign configuration. W.P. acquired the trained behaviors rapidly

Figure 69

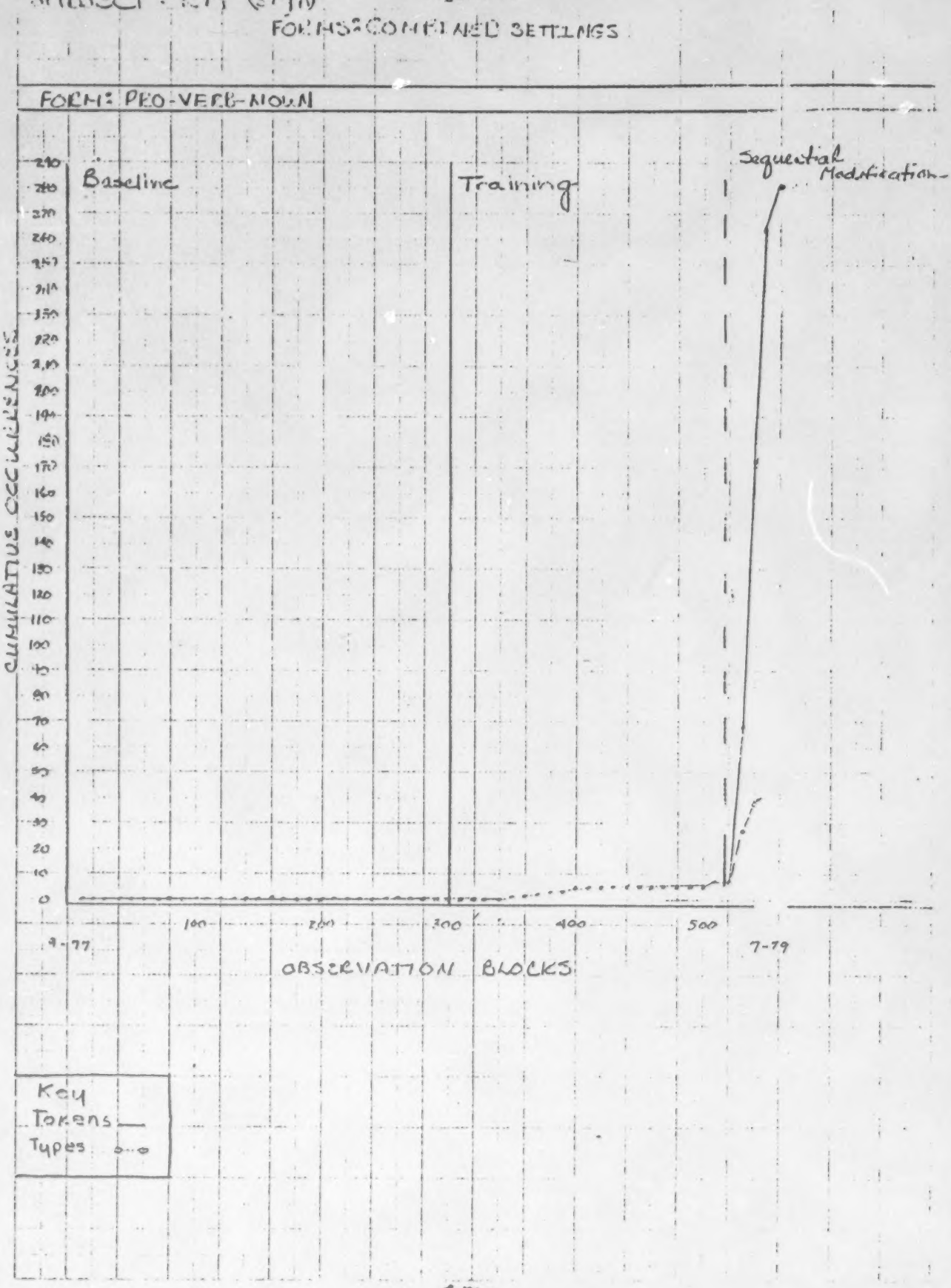

SUBJECT: KM (sign)
FORMS: COMBINED SETTINGS
FORM: PRO-VERB-NOUN
Baseline
Training
Sequential Modification
CUMULATIVE OCCURRENCES
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
300
100
200
300
400
500
9-77
7-79
OBSERVATION BLOCKS
Key
Tokens
Types

Figure 70

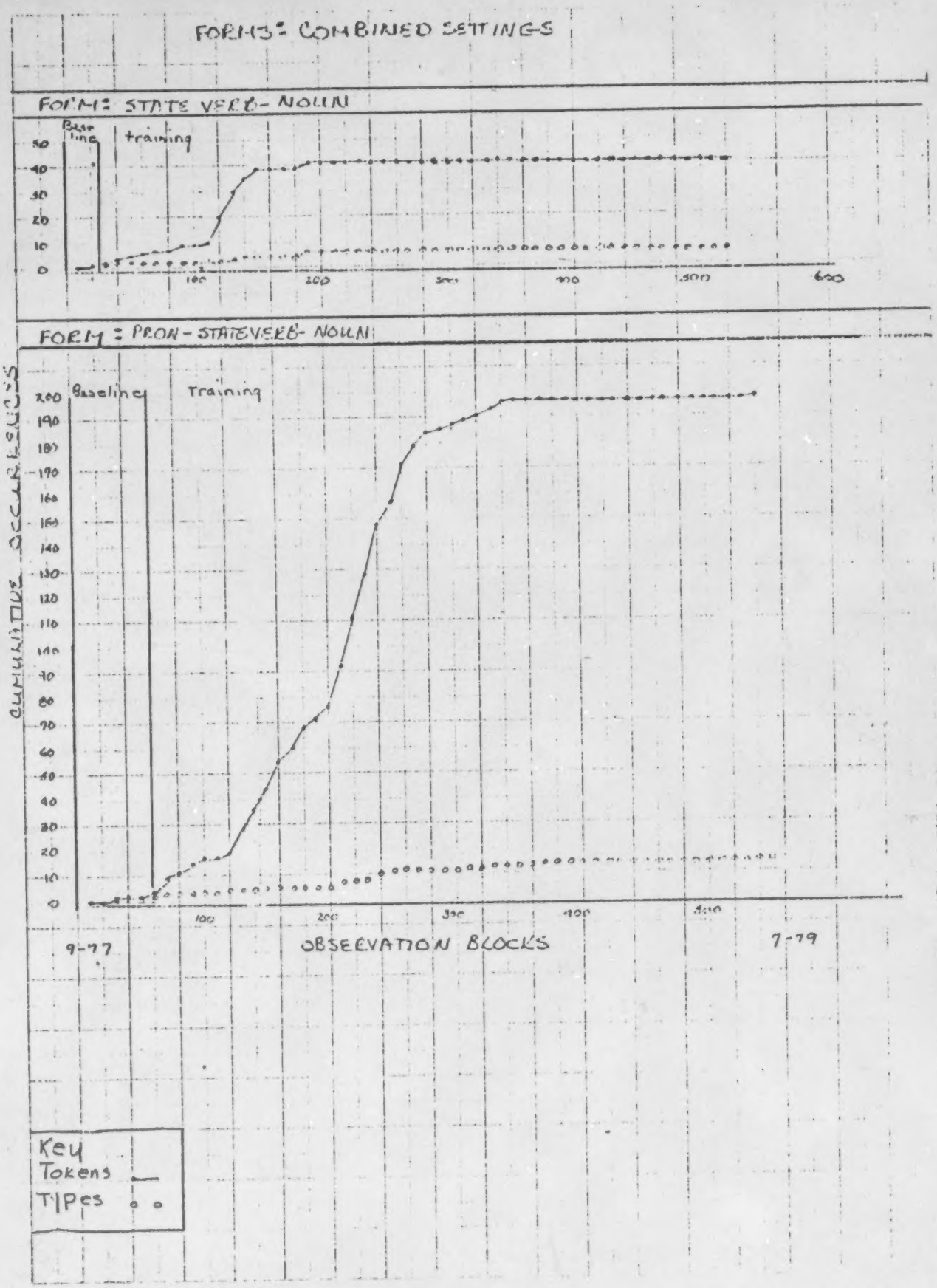
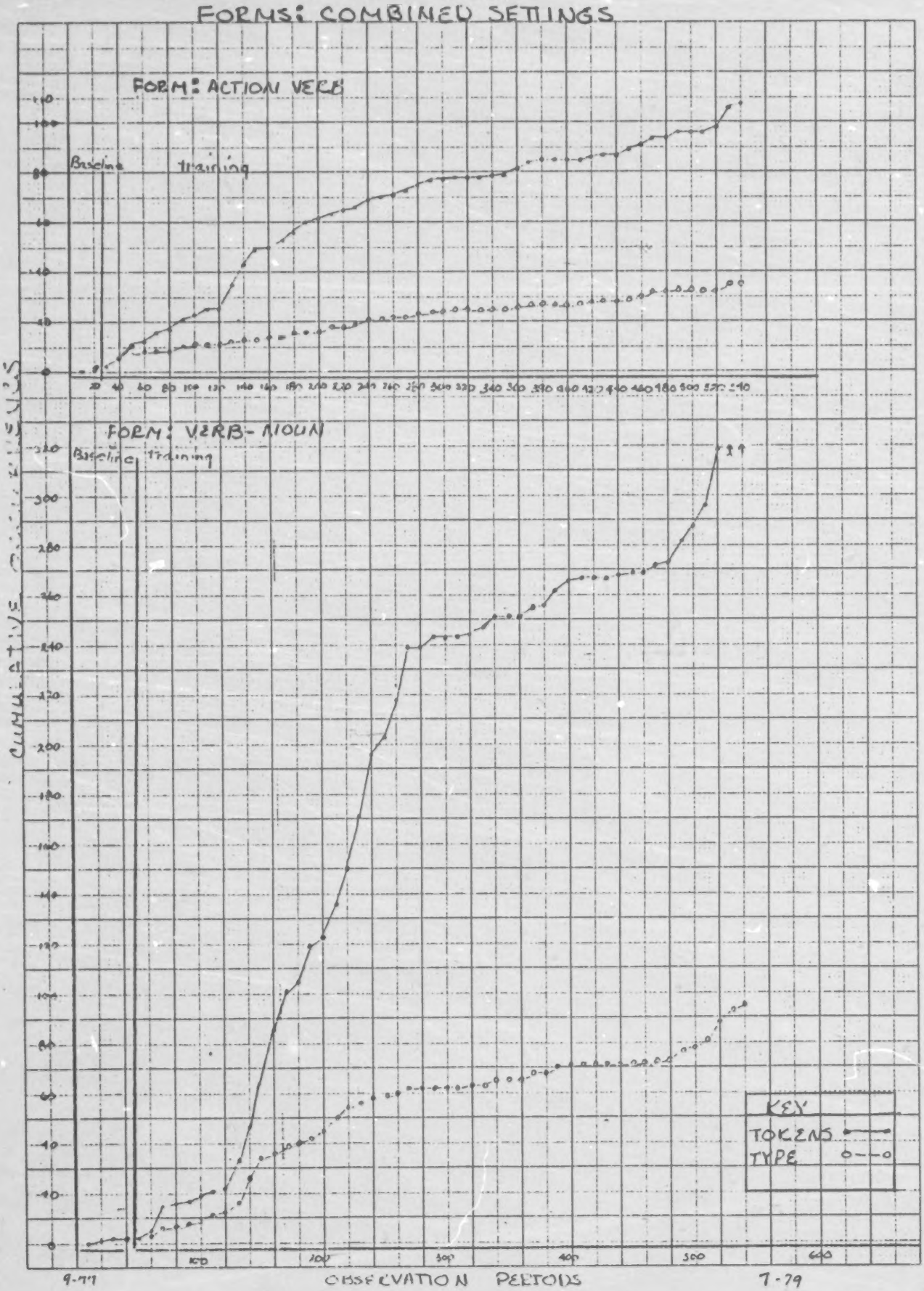

FORMS: COMBINED SETTINGS
FORM: STATE VERB - NOUN
Baseline
training
FORM: PRON - STATE VERB - NOUN
Baseline
Training
CUMULATIVE OCCURRENCES
OBSERVATION BLOCKS
9-77
7-79
Key
Tokens
Types

Figure 71


FORMS: COMBINED SETTINGS
FORM: ACTION VERB
Baseline
Training
FORM: VERB-NOUN
Baseline
Training
CUMULATIVE
KEY
TOKENS
TYPE
9-77
OBSERVATION PERIODS
7-79

and showed structural generalization. W.P. received training over a ten-month period.

Assessment

Pretest and posttest scores on the following tests were:

	Pre	Post	Change
PPVT	M.A. 3-8 yrs.	M.A. 5-8 yrs.	2 years
Houston	M.A. 25.6 mkT	H.A. 36.0 mo.	4.4 mo.

Final results showed a major increase in vocabulary acquisition and a slight increase in receptive and expressive language. W.P.'s total vocabulary at the end of training was 217 words.

Word Acquisition

W.P. showed increases in vocabulary after the first four weeks of training. Acquisition varied across weeks until the final three weeks of training in which three new words were acquired each week.

Structural Generalization

W.P. showed very little structural generalization across all trained structures in the academic setting. His structural generalization can be seen in Figures 72-74. The Verb-Noun form generalized in the freeplay setting. Overall generalization of forms was moderate. W.P. showed dramatic increases in generalization when a sequential modification procedure was used in one of two related settings, lunch and breakfast.

Complexity Effects

MLU varied from 1.18 to 1.72 in nonreinforced language settings with the highest MLU (1.82) occurring in a training setting (lunch). Length of utterances varied between two and five words with an average of three words. Twenty-four percent of the total utterances were first occurrences.

Summary

W.P. displayed moderate generalization. Comparisons between the verbatim samples, rate code, and complexity measures showed that W.P. used more trained structures in freeplay, but used other nontargeted structures (adjective noun) in the academic setting. Many topic/comment structures (e.g., "Home, Kevin.") were used. Standardized test measures showed that W.P. made increases in both vocabulary acquisition and global language. Data suggested that training W.P. in settings that had features in common maximized generalization across settings.

Figure 72

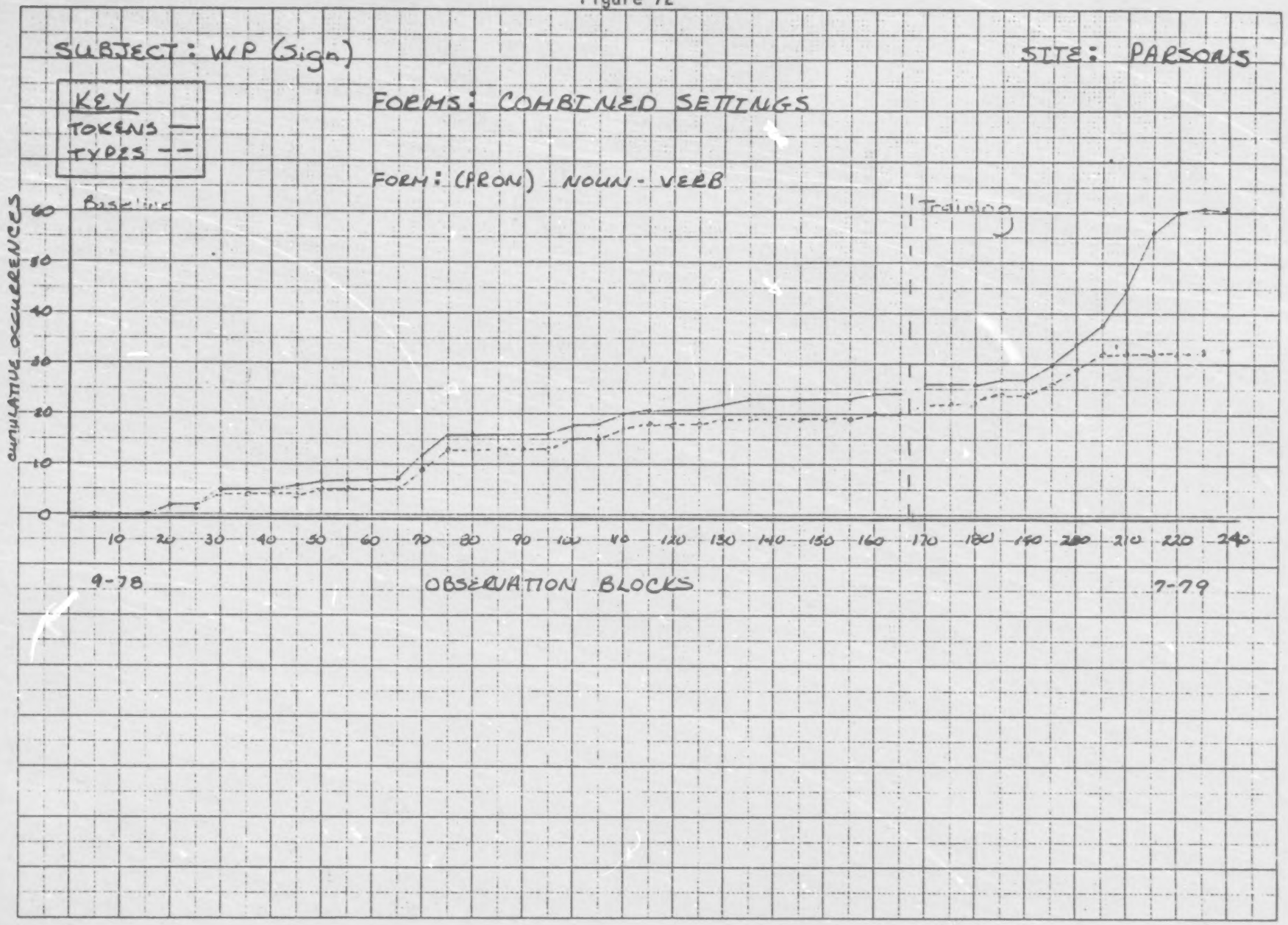
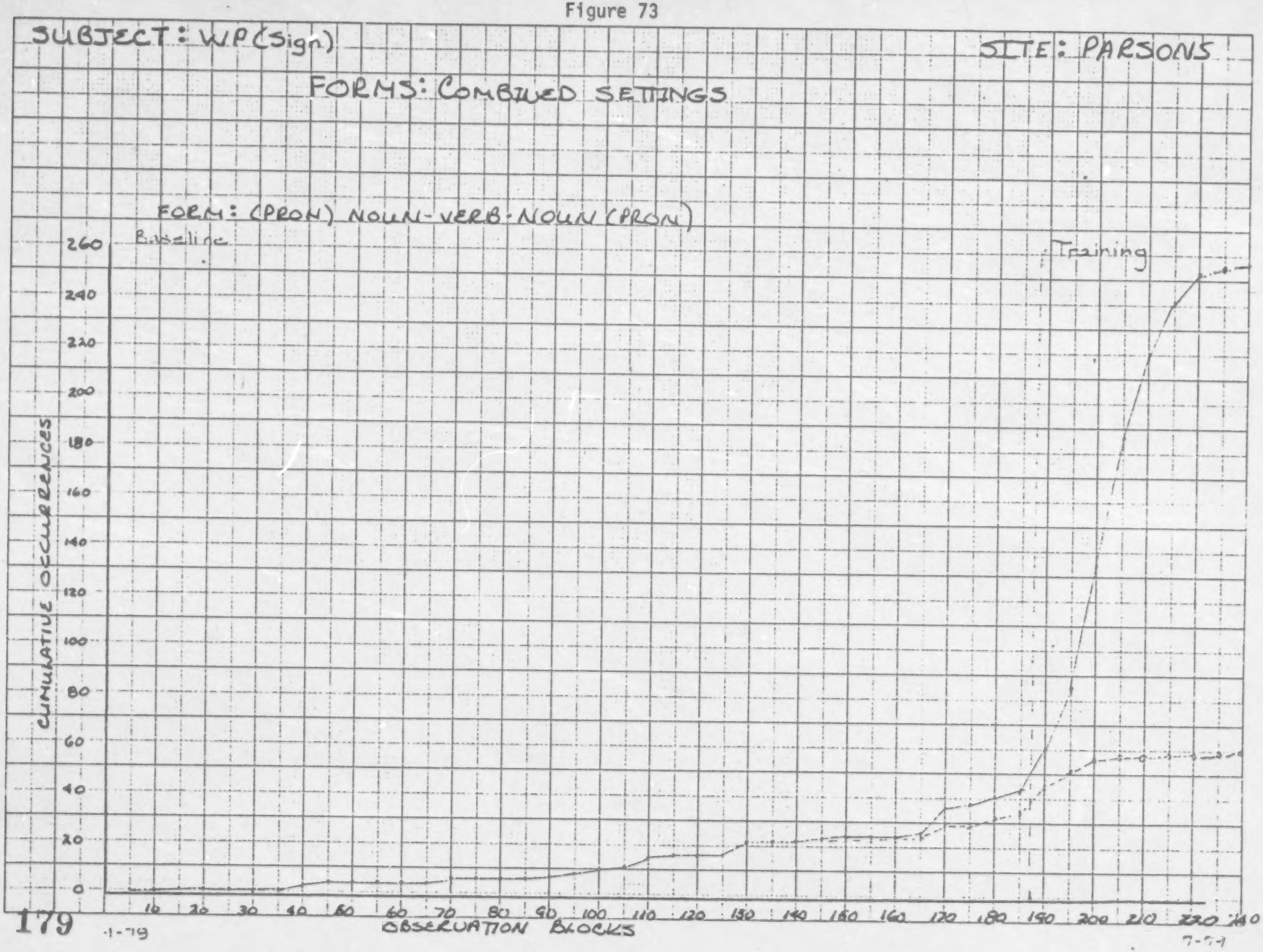

SUBJECT: WP (Sign)
SITE: PARSONS
KEY
TOKENS —
TYPES --
FORMS: COMBINED SETTINGS
FORM: (PRON) NOUN - VERB
Baseline
Training
CUMULATIVE OCCURRENCES
0
10
20
30
40
50
60
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 240
9-78
OBSERVATION BLOCKS
7-79

Figure 73



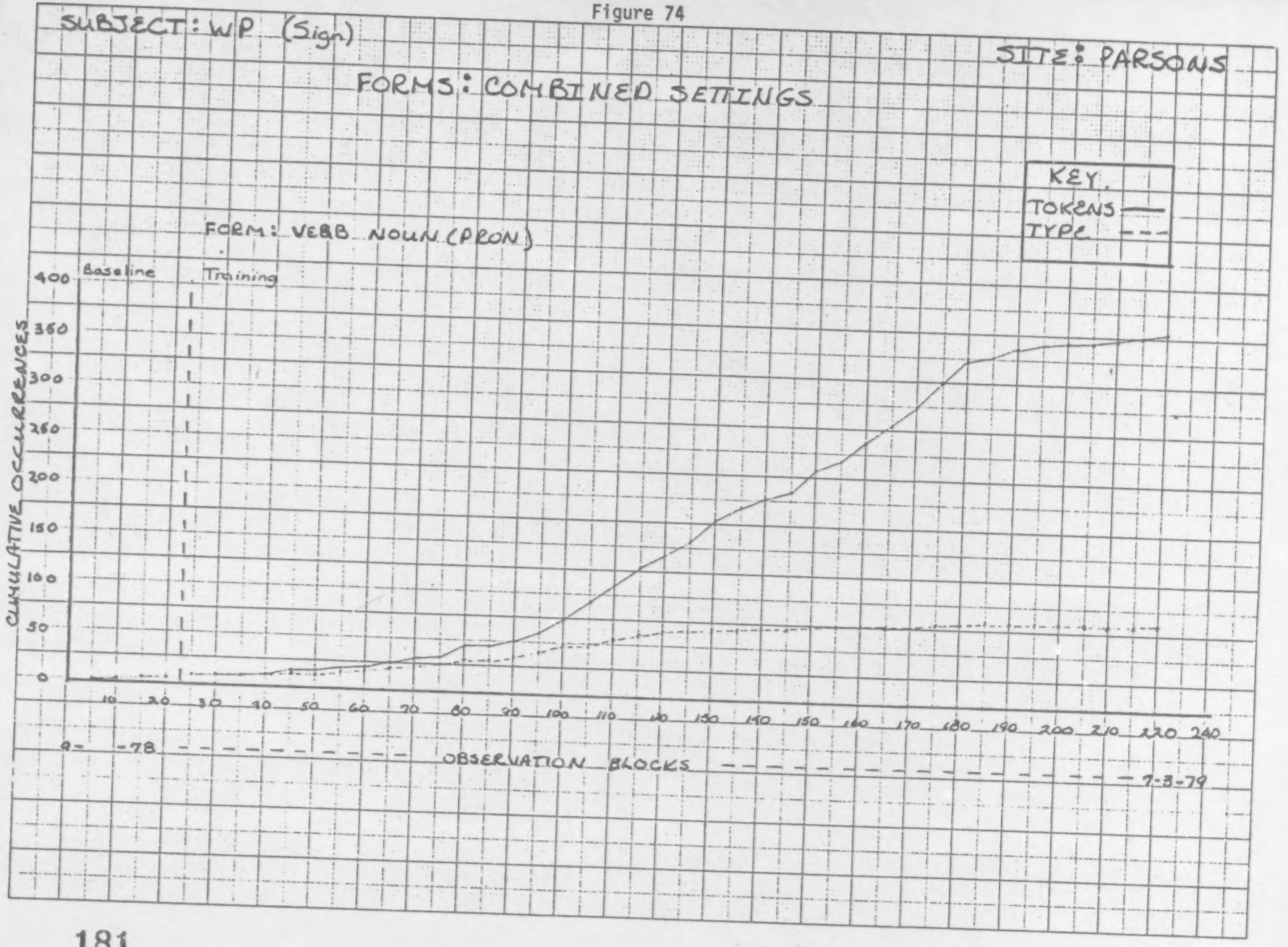
1-79

7-7-1

No. R 2470 10 C 1980 10 mm 10 a cm • Made in U S A

VERNON ROGER INC. CLIFTON, N.J. 07014

Figure 74



No. R2270-10C ... 10 mm ... VERNON ROLLER INC.

Subject: J.R. Sex: Male Age: 14.0

Training

J.R. received manual sign training on the following structures: Verbs, Verb-Noun, Pron/Noun-Verb-Noun. J.R. acquired language skills extremely rapidly in training. He received training on a total communication program and was in training for eight months.

Assessments

J.R. demonstrated no change in pre-and-posttests on either the PPVT or Houston (II).

Word Acquisition

J.R. showed no major growth in vocabulary until after the 15th week of training. Total vocabulary for J.R. was 130 words.

Structural Generalization

The three trained behaviors generalized only very minimally to any of the nontraining setting. Data are shown in Figure 75.

Complexity Effects

MLU varied from 1.00 to 1.88 in the nontraining settings. MLU systematically increased in the academic setting. The longest utterances ranged from one to five words.

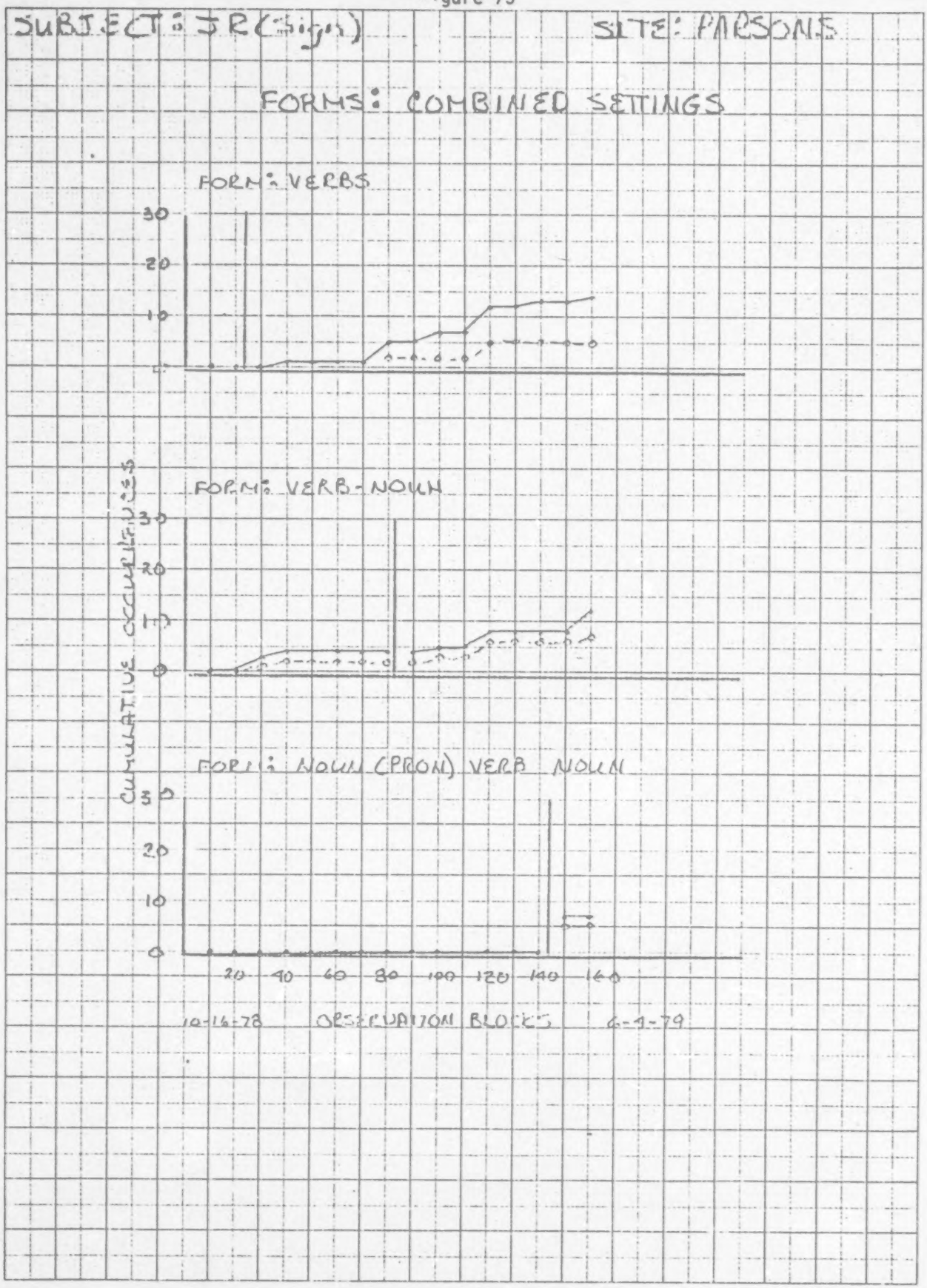
Rate Effects

Rate code probes indicated that teacher verbalizations and child verbalizations were extremely low.

Summary

J.R. showed only minimal generalization and no increases in test scores although he acquired behaviors very rapidly in training. J.R.'s profound hearing loss may have contributed to the lack of generalization. A total communication approach was not utilized in the classroom setting.

Figure 75



No R2470 10C 19 0610 10 mm to a cm • Made in U.S.A.
VERNON ROYLE INC. ELIZABETH N.J. 07208

Subject: M.G. Sex: Male Age: 14.4

Training

M.G. received manual sign training on the following structures: Verb/Noun, Pron-Verb (state)-Noun. M.G. acquired the trained behaviors and demonstrated structural generalization after 40 exemplars were trained. He received training across a 19-month period.

Assessment

Increases in pre-posttest scores on the PPVT and Houston standardized tests were four months and eight months respectively. These changes reflected an increase in overall language development more than increases in vocabulary.

Word Acquisition

M.G. began acquiring new words after the second week of training. Most vocabulary was acquired during the first nine weeks of training. After that, M.G. acquired approximately one new word a week. M.G.'s total vocabulary was 160 words. New training words were used in isolation before being used in combinations.

Structural Generalization

M.G. displayed moderate generalization of both training structures, particularly in the academic setting. The Verb-Noun structure generalized at a higher rate than did the Pronoun-Verb (state)-Noun structure. M.G.'s highest rate of generalization occurred approximately two months after training was initiated. These data are shown in Figures 76-77.

Complexity Effects

MLU did not increase during training except in the training-lunch setting. Training MLU increased from 1.08 to 1.62; nontraining MLU varied from 1.00 to 1.44. The longest utterances ranged between one to three words. Twenty-three percent of all Verb-Noun utterances were first occurrences.

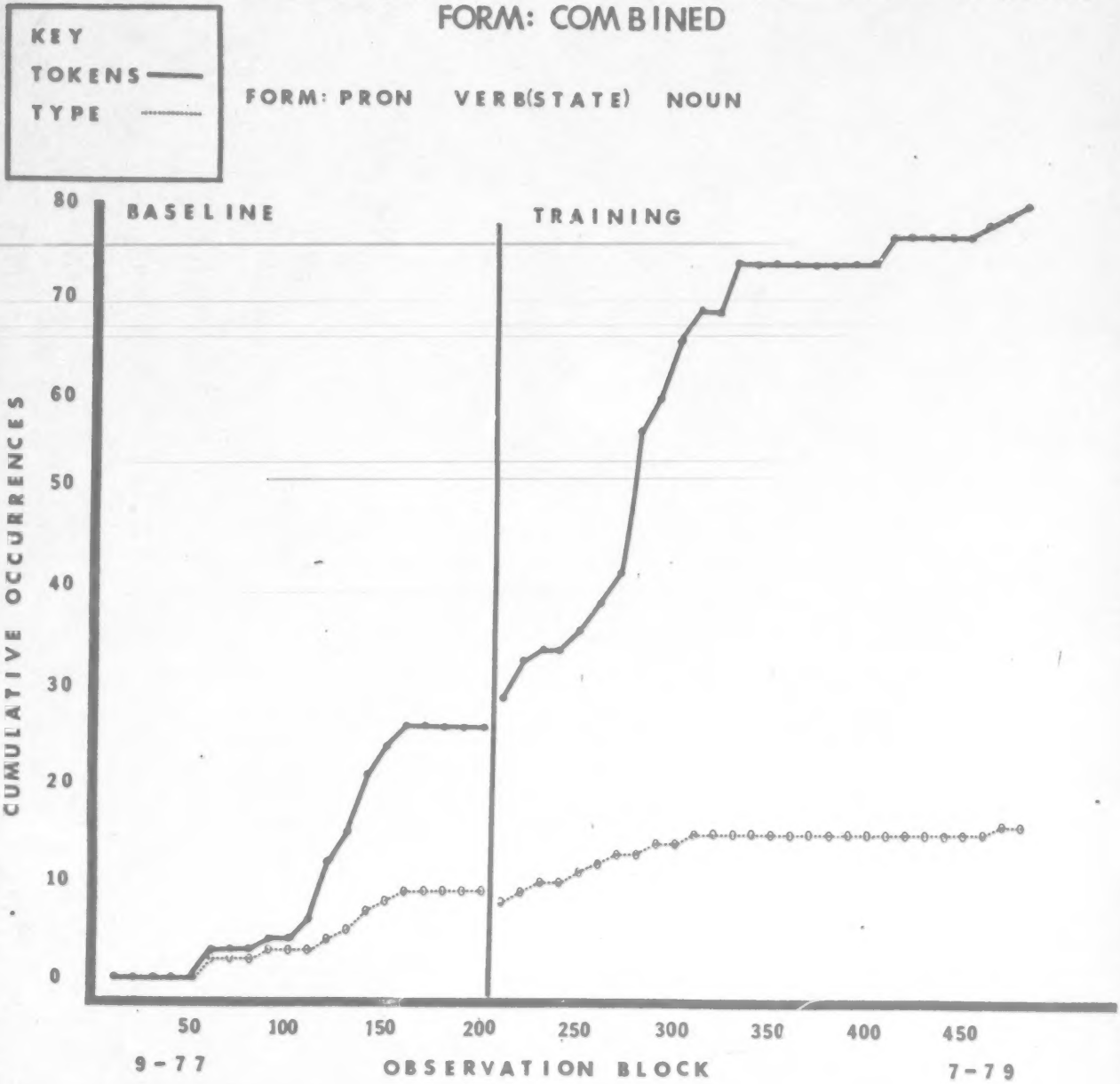
Summary

M.G. displayed moderate generalization during the training period. Increases in vocabulary and overall language development were evident in test scores. M.G. also generalized some vocal approximations paired with signs during training to nontraining settings.

Figure 76

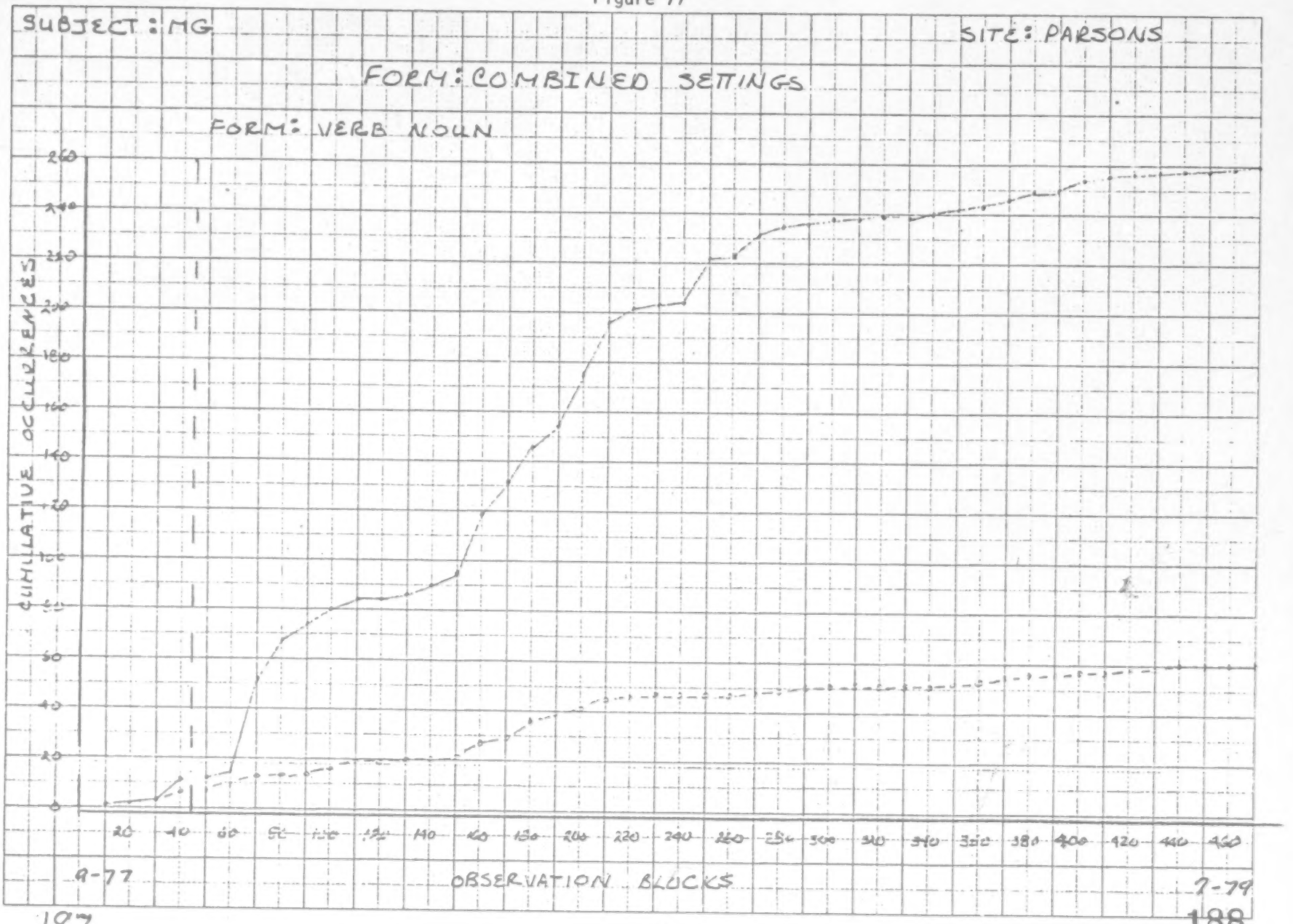
SUBJECT: MG(Sign) SITE: PARSONS

FORM: COMBINED



VERNON ROYAL INC ELIZABETH, N.J. 07208 No R 2470-10-C-19 0610: 10 mm to a cm. • Made in U.S.A.

Figure 77



Subject: C.W. Sex: Male Age: 10.9

Training

C.W. received speech and language training on the following structures: Verb-Noun, (Pronoun) Noun-Verb-Noun (Pronoun). C.W. did not reach acquisition criterion in structured training setting although he was trained for more than two years. Criterion was met only after the training was modified to a semi-structured approach.

Assessment

Increases in pre-posttest scores on the PPVT and Houston were five months and one month respectively. Over the two-year period, these changes reflect little growth in language development.

Word Acquisition

C.W. showed dramatic increases in vocabulary after the 45th week of training and acquired approximately five words every two weeks thereafter. Total vocabulary was 555 words.

Structural Generalization

C.W. demonstrated moderate generalization in the academic setting before he met training criterion. However, generalization to the freeplay setting did not increase significantly from the baseline condition. These data are shown in Figures 78-79.

Complexity Effects

MLU increased in the academic setting but decreased in freeplay during the last nine months. Longest utterances ranged from three to seven words, however, many of the longer utterances were stereotypic phrases. Twenty-nine percent of the total generalized structures were first occurrences.

Rate Effects

Although the number of verbalizations directed to C.W. were twice as high in the academic setting as in the freeplay setting, C.W.'s rate of verbalization did not vary between settings. His initiations and responses to obligatory verbalizations were higher in the unstructured setting where there were fewer opportunities to respond. Most generalization occurred in the academic setting. In comparison to the other subjects, fewer of C.W.'s verbalizations were consequated by adults.

Summary

C.W. displayed moderate generalization in the academic setting only. His generalization increased after training was initiated although his

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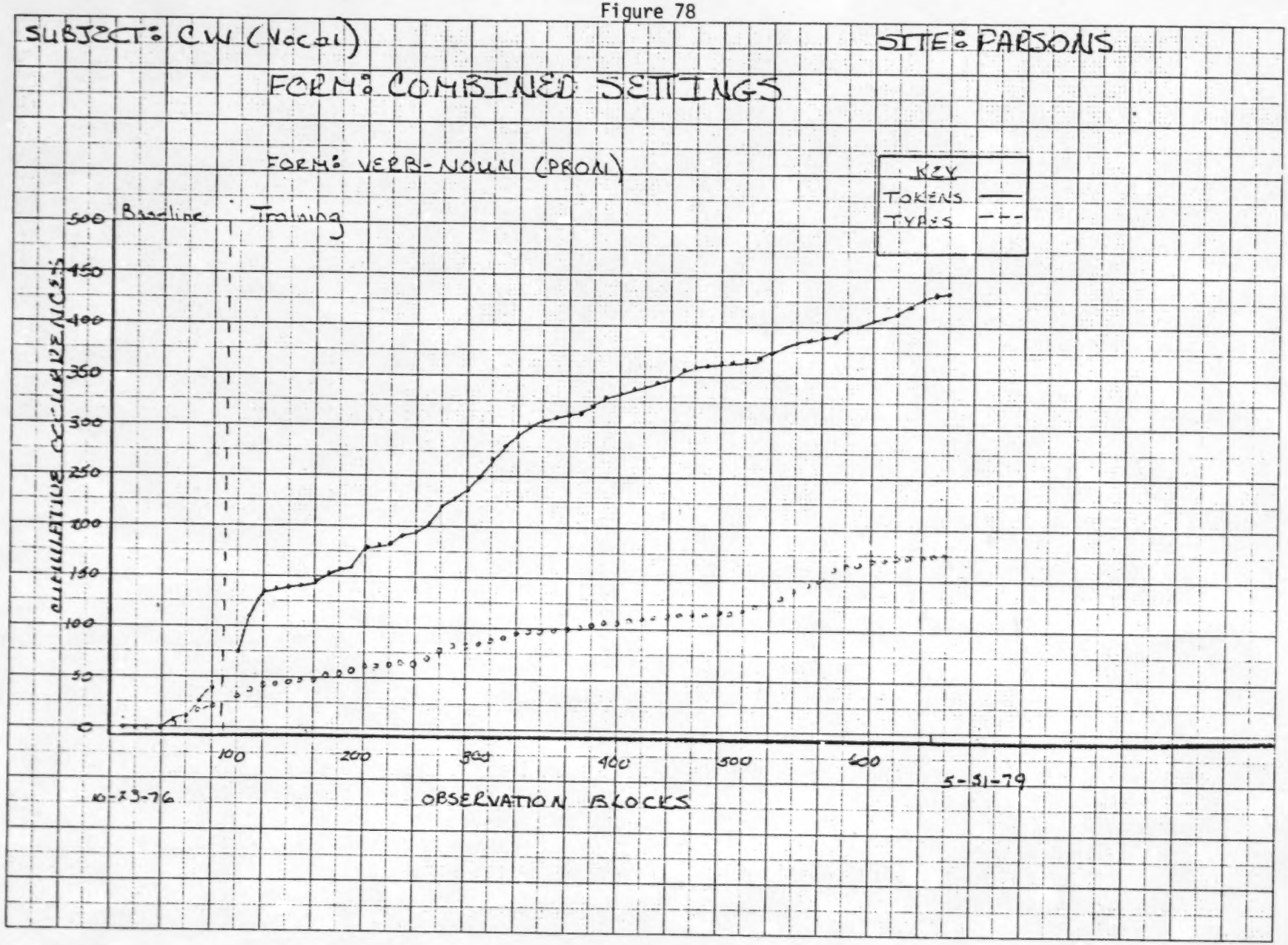
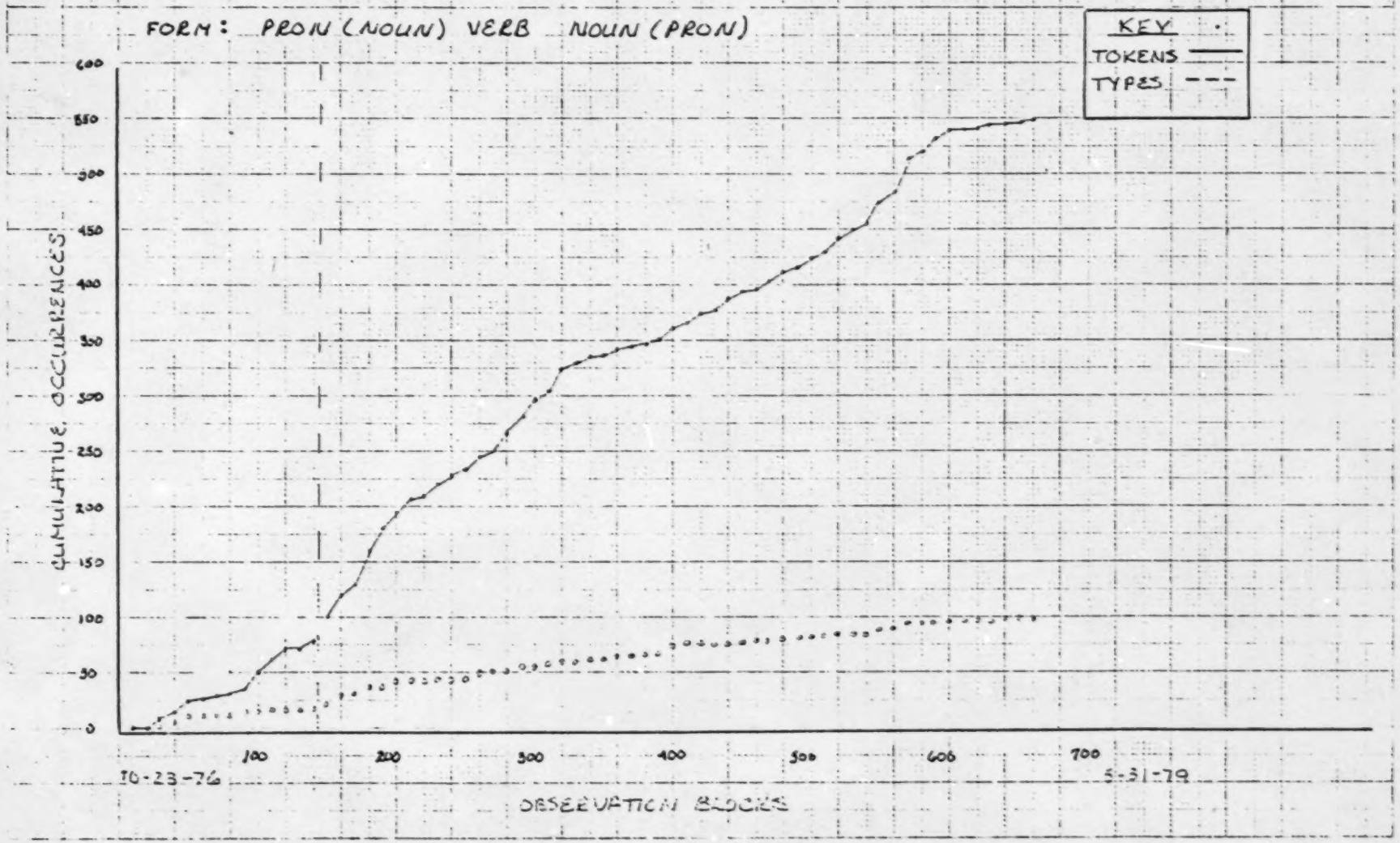
Figure 78



SUBJECT: CW (Vocal) Figure 79 SITE: PARSONS

FORM: COMBINED SETTINGS



acquisition in training was extremely slow until training was modified to a less structured program. His rate of verbalizations did not vary between settings.

Subject: C.R. Sex: Male Age: 12.2

Training

C.R. received speech and training training on the following structures: Verb-Noun, (Pronoun)-Noun-Verb-Noun (Pronoun). C.R. acquired two-word structures fairly rapidly but required longer training for three-word utterances. He received training across a ten-month period.

Assessment

Increases in pre-posttest scores on the PPVT and Houston were 2.3 years and five months respectively. These changes indicate major growth in vocabulary and some growth in global language development.

Word Acquisition

After training was initiated, C.R. acquired approximately three new words each week. C.R. had a total vocabulary of 39 words at the end of training. New words trained in structures were used in isolation before they were used in combination.

Structural Generalization

C.R. showed moderate generalization in the academic setting. Generalization occurred soon after training was initiated and continued at fairly high levels throughout the remainder of the observational period. C.R.'s use of two-word utterances did not decrease even though two word combinations were incorporated into three-word utterances. His structural generalization is summarized in Figure 80.

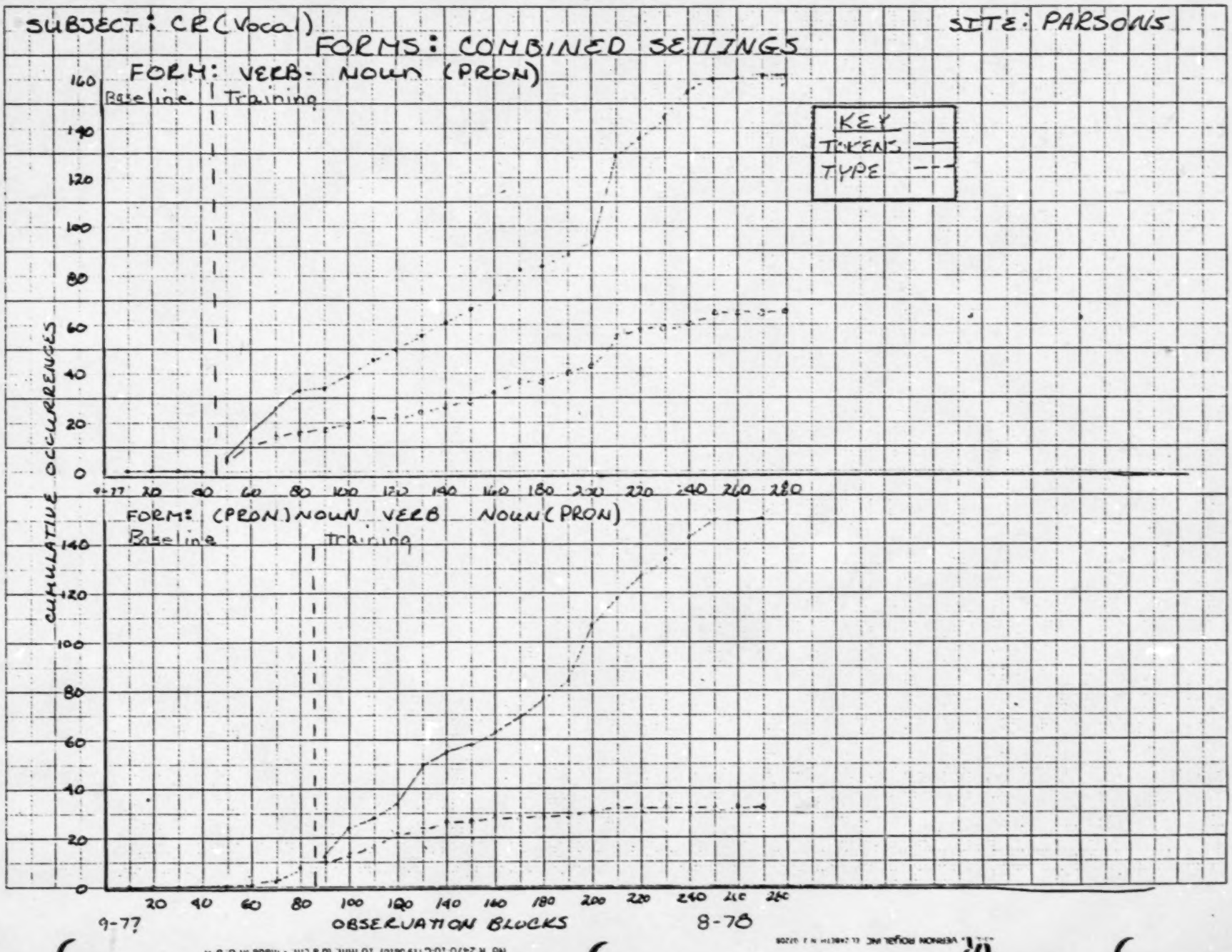
Complexity Effect

MLU increased slightly during the final phase of training. Longest utterances varied from two to four words. Thirty percent of all utterances were first occurrences.

Summary

C.R. displayed moderate generalization in all settings with highest levels of generalization occurring in the academic setting. Standardized test measures indicate growth in vocabulary and global language development.

Figure 80


SUBJECT: CR (Vocal)
SITE: PARSONS
FORMS: COMBINED SETTINGS
FORM: VERB- NOUN (PRON)
Baseline
Training
KEY
TOKENS
TYPE
CUMULATIVE OCCURRENCES
0
20
40
60
80
100
120
140
160
9-77
20
40
60
80
100
120
140
160
180
200
220
240
260
280
FORM: (PRON) NOUN VERB NOUN (PRON)
Baseline
Training
OBSERVATION BLOCKS
9-77
8-78

Subject: T.B. Sex: Male Age: 11.0

Training

T.B. received speech and language training on the following structures: Objective and Subjective Pronouns; Extended Articles: a, the, some'; "Wh is/are" Questions; "Is/Are" Reversal Questions. The last two structures were trained in an academic setting. T.B. acquired the receptive tasks quite slowly but subsequently showed rapid acquisition of the productive tasks. Training occurred during a seven-month period.

Assessment

Increases in pre-posttest scores on the PPVT and Houston standardized tests were 2.10 years and one month respectively. T.M. scored at the three-year level on the global language tests. The gains made in the receptive task (PPVT) may be due partly to correct positioning and vision correction.

Word Acquisition

T.B. had a total vocabulary of 840 words at the end of training. He acquired new vocabulary rapidly throughout training.

Structural Generalization

T.B. showed moderate to high generalization on trained structures. Baseline on articles (a, the, some) was taken after training criterion was met and a sequential modification procedure was initiated. T.B. generalized more rapidly as new structures were trained. Graphs of these effects are shown in Figures 81-84.

Complexity Effects

MLU varied from 2.09 to 3.44 words with the longest utterance ranging between five and ten words. First occurrences comprised from 31% to 70% of the total utterances. The high percentages of first occurrences were probably due to the complexity of language being trained for T.B. in comparison to other subjects.

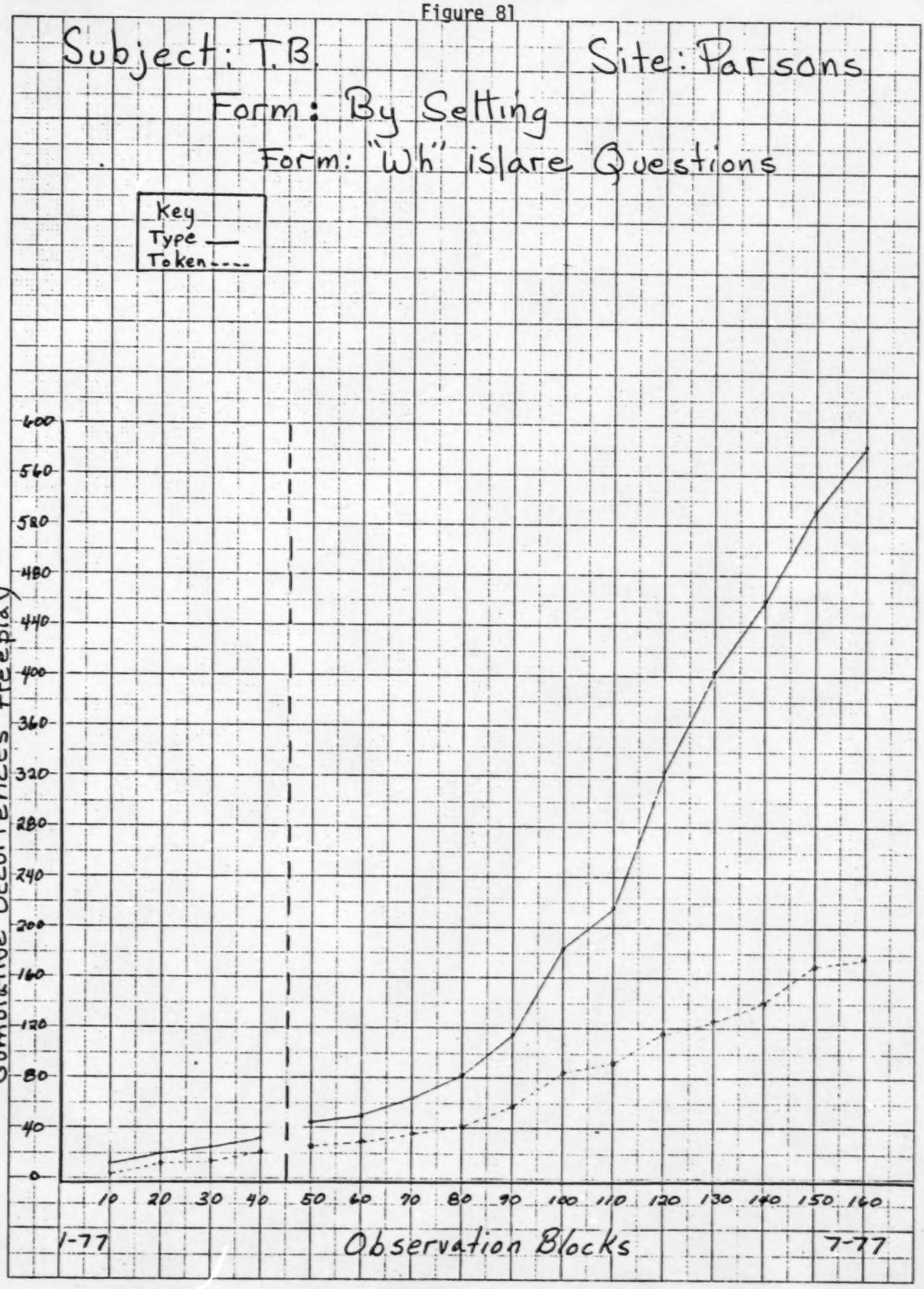
Rate Effects

T.B.'s verbalized frequently and many verbalizations were directed to him. He responded to approximately 70% of all obligatory verbalizations and his verbalizations were frequently consequated.

Summary

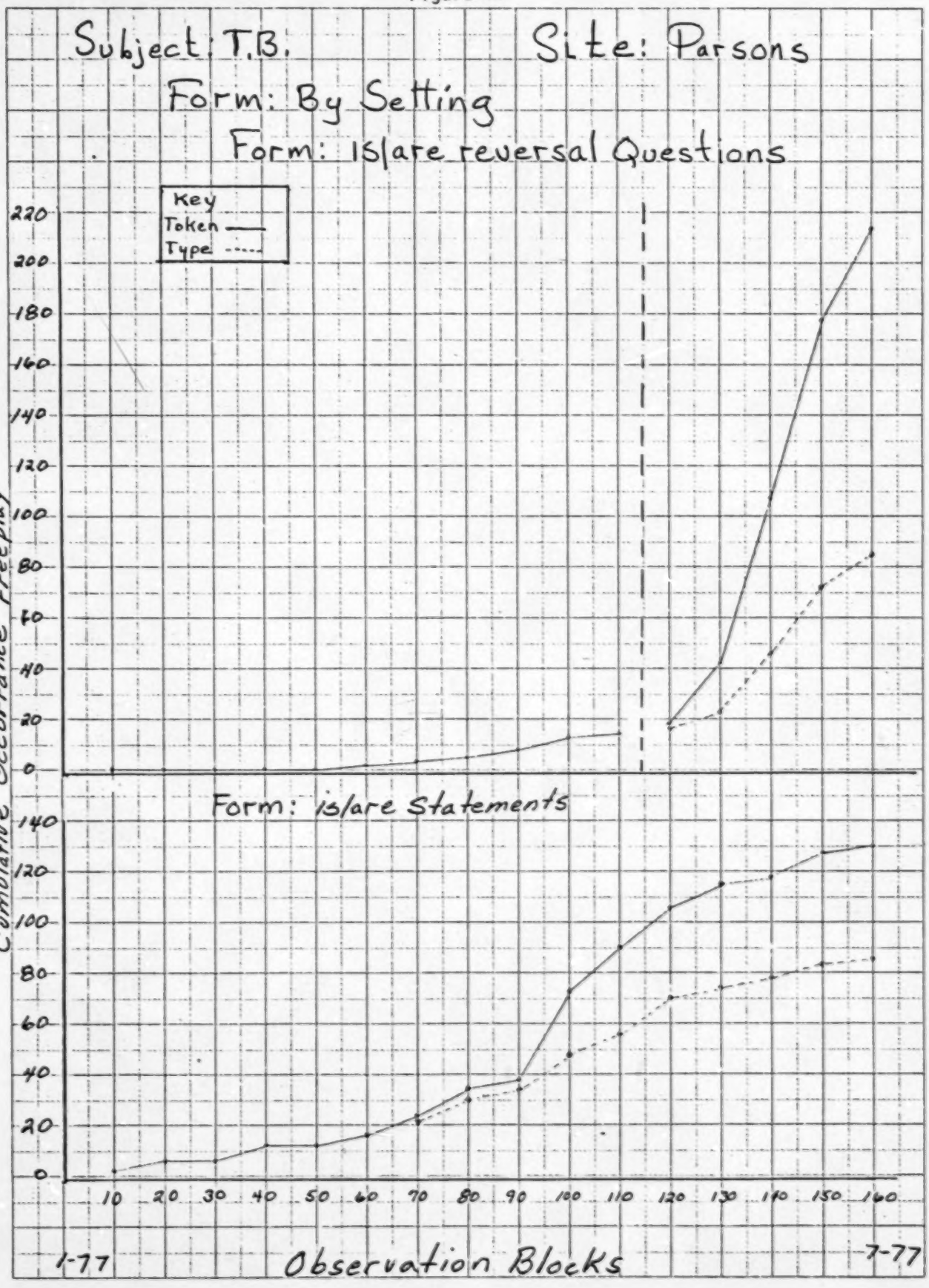
T.B. displayed moderate to high generalization of trained structures. Both observational measures indicated language growth. However, only vocabulary acquisition showed dramatic increases on standardized tests.

Figure 81



No R 2470-10C 1906101 10 mm to a cm - Made in U S A
VERNON ROYLE INC. ELIZABETH N J 07206

Figure 82



No R 2470 10C. 1980(6): 10 mm. to a cm. - Made in U.S.A.
VERNON HOUSE, INC. ELIZABETH, N.J. 07208

Figure 83

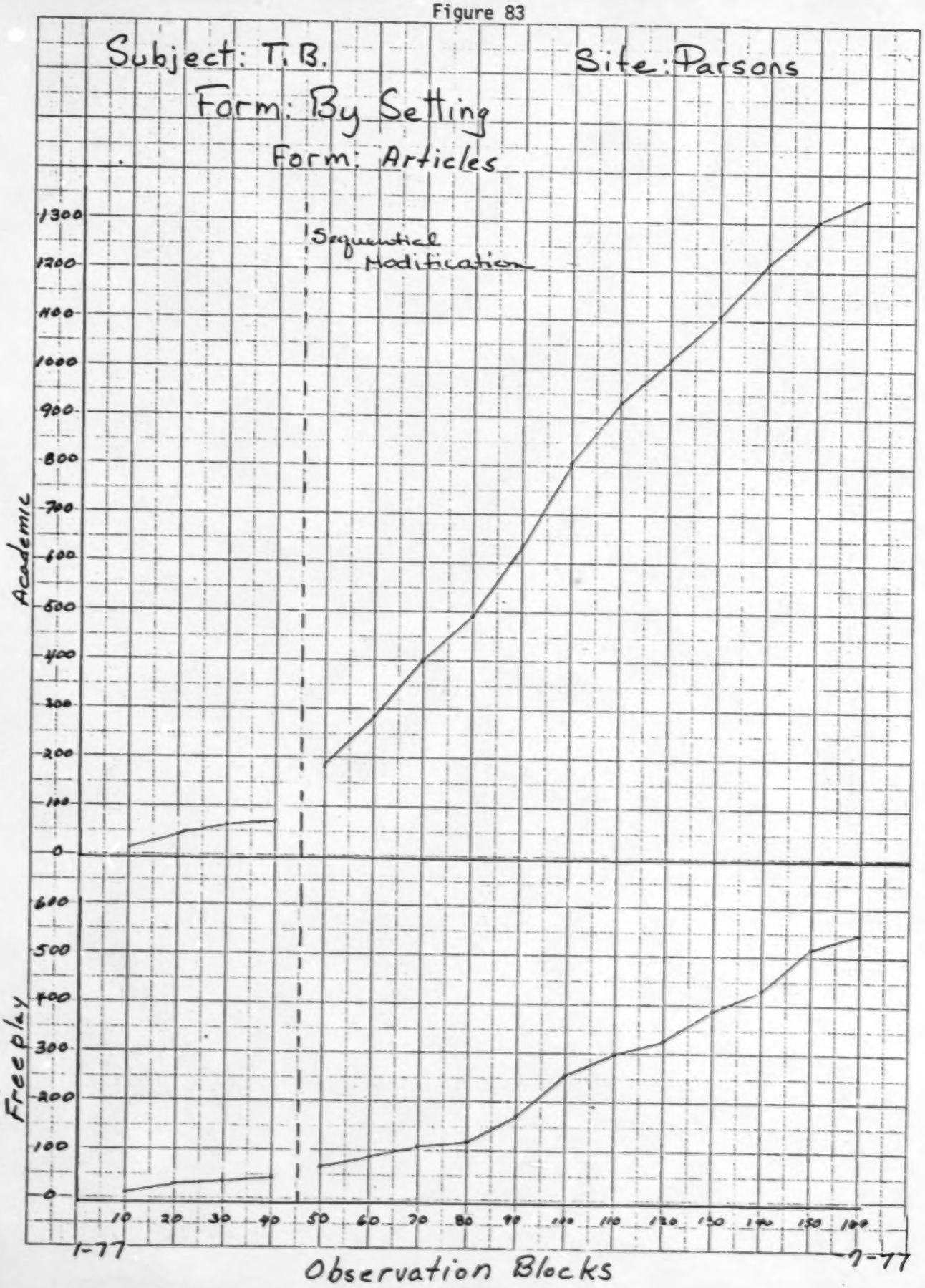
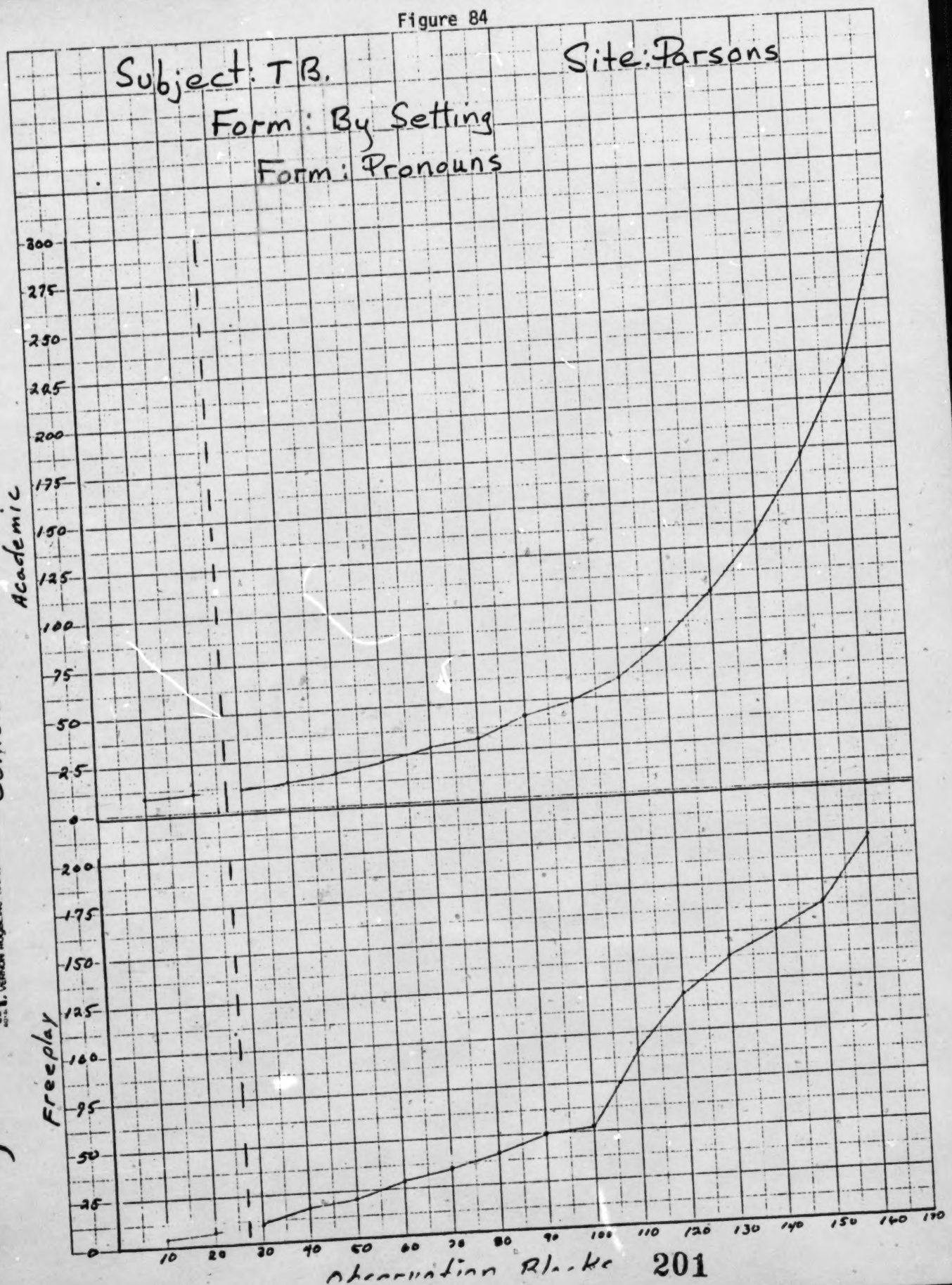

Subject: T. B.
Site: Parsons
Form: By Setting
Form: Articles
Sequential Modification
Academic
Freeplay
Cumulative Occurrance
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
600
500
400
300
200
100
0
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
1-77
7-77
Observation Blocks

Figure 84


Subject: T B.
Site: Parsons
Form: By Setting
Form: Pronouns
Cumulative Occurrence
Academic
Freeplay
Observation Blocks
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170
0 25 50 75 100 125 150 175 200 225 250 275 300
0 25 50 75 100 125 150 160 175 200

Subject: R.B. Sex: Male Age: 9.7

Training

R.B. received training on the following structures: Verb (State) Noun; Verb (Action) Noun (Pronoun); (Pronoun) Noun-Verb; Verb-Adverb; Noun-Verb-Noun; Pronoun-Verb-Pronoun; Verb-Noun-Adverb/Noun-Verb-Adverb; Verb-Prep-Noun; Noun-Verb-Prep-Noun; Noun-Verb (Prep) Mod-Noun. R.B. received concurrent training on some structures. He acquired behaviors in training extremely rapidly and demonstrated structural generalization to untrained combinations. Training and observations occurred over a nine-month period. R.B. was in a full day behavioral program with one adult to decrease head-banging, therefore, the setting differences were minor and data for all settings have been combined.

Assessment

Increases in pre-posttest scores on the PPVT and Houston were 1.9 years and two months. Increases on articulation tests were dramatic.

Word Acquisition

R.B. had a total of 435 words at the end of training. He acquired approximately 50 new words each month. R.B. used these new words in combinations although the resulting utterances were not always grammatical.

Structural Generalization

R.B. demonstrated moderate to high generalization of many two-, three-, and four-word utterances. The Verb-Noun and Verb-Adverb structures generalized at the highest rate. State-Verb-Noun structures were trained concurrently but did not generalize as readily. In general, frequency of two-word utterances did not decrease as they were incorporated into more complex syntactic structures. Structural generalization data are shown in Figures 85-88.

Complexity Effects

MLU measures gradually and systematically increased over time. Longest utterances varied from four to five words. Approximately 60% of all utterances were first occurrences.

Rate Code Effects

Verbalizations to and by R.B. were high rate. Twice as many teacher and child verbalizations of R.B. and obligatory response opportunities occurred in the academic setting as in the freeplay setting. However, R.B.'s responses to obligatory verbalizations and consequences for his verbal behavior varied only slightly across settings.

Figure 85

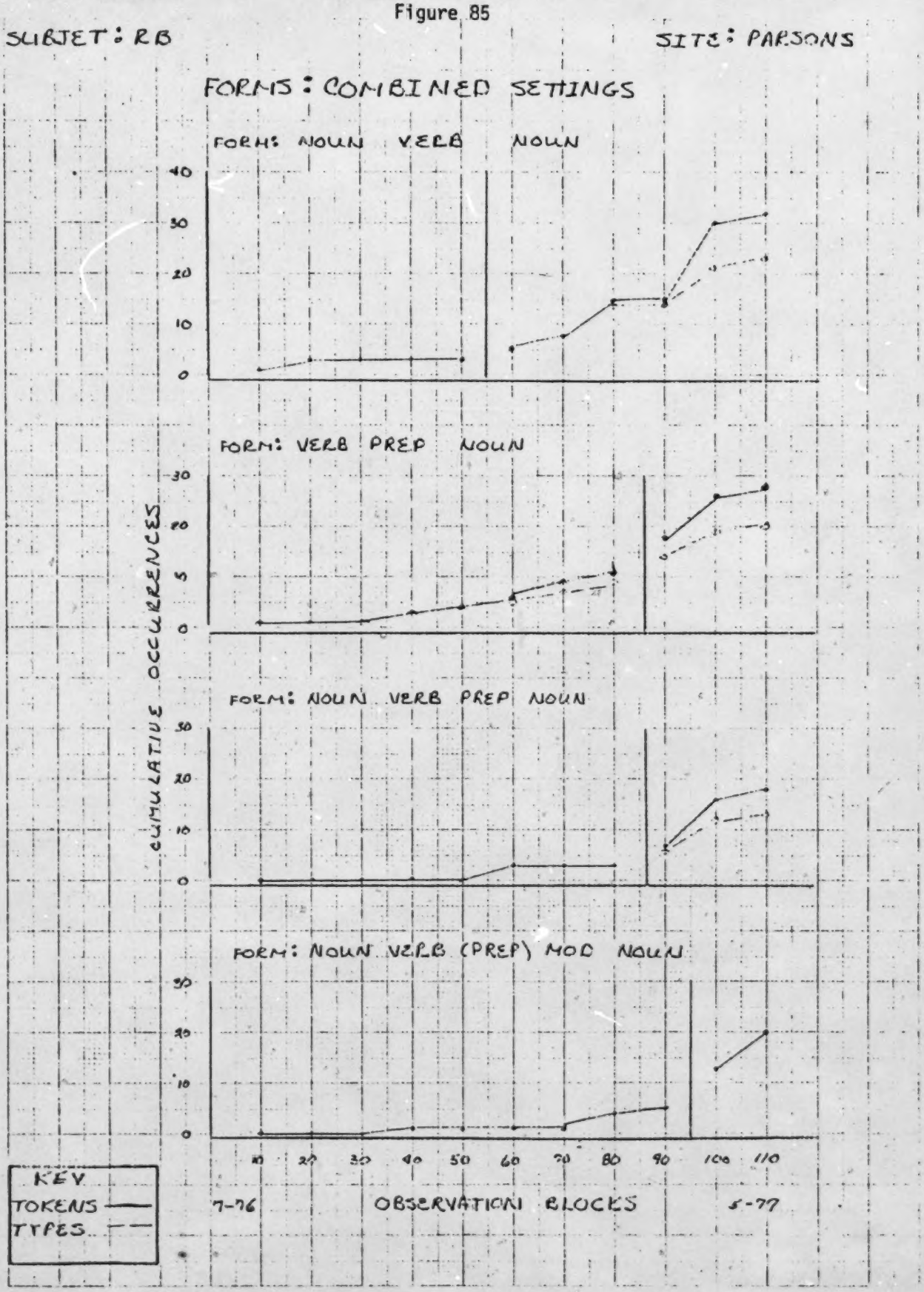

SUBJET: RB
SITE: PARSONS
FORMS: COMBINED SETTINGS
FORM: NOUN VERB NOUN
FORM: VERB PREP NOUN
FORM: NOUN VERB PREP NOUN
FORM: NOUN VERB (PREP) MOD NOUN
CUMULATIVE OCCURRENCES
0
10
20
30
40
50
60
70
80
90
100
110
KEY
TOKENS
TYPES
7-76
OBSERVATION BLOCKS
5-77

Figure 86

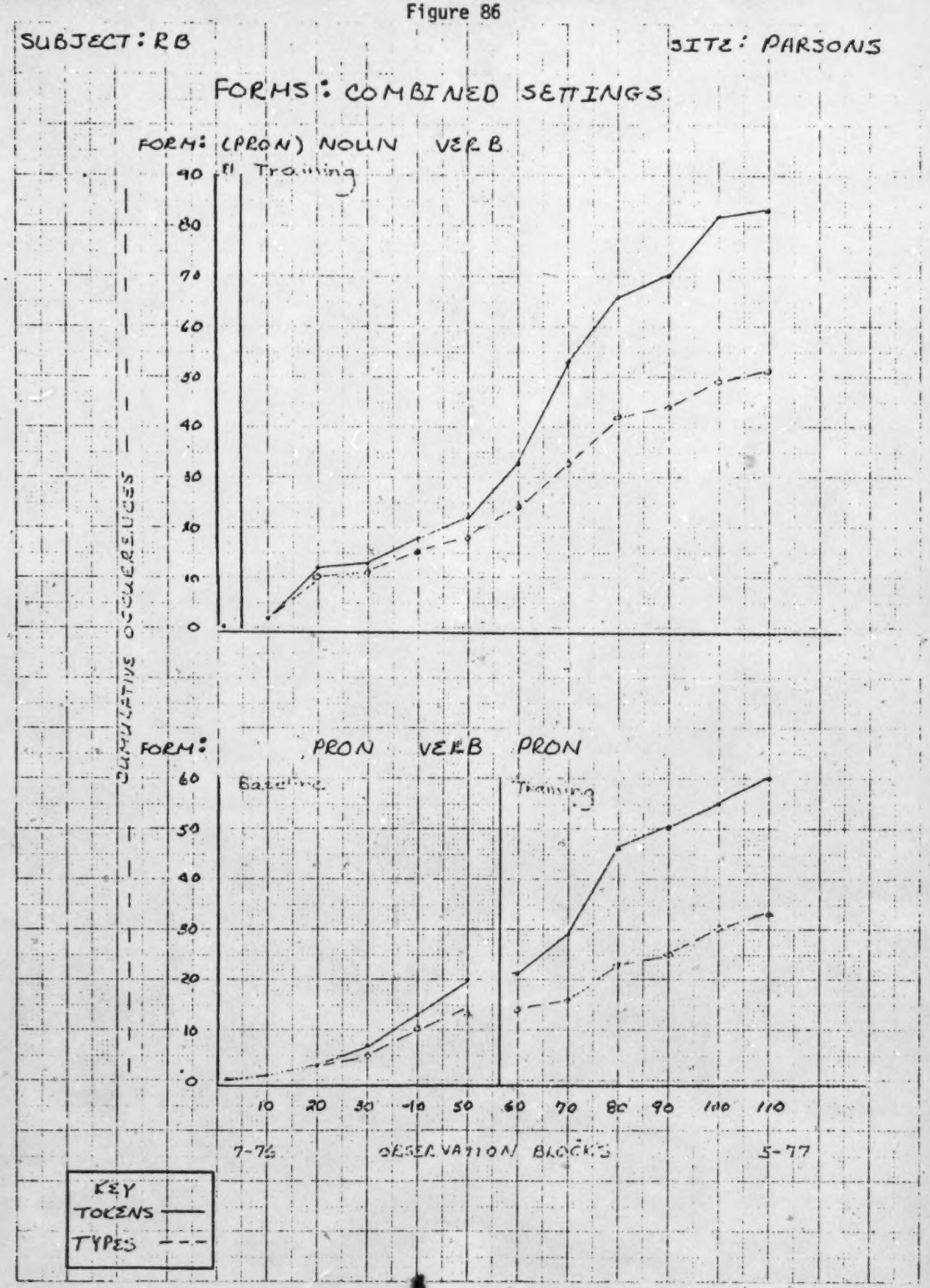

SUBJECT: RB
SITE: PARSONS
FORMS: COMBINED SETTINGS
FORM: (PRON) NOUN VERB
Baseline
Training
FORM: PRON VERB PRON
Baseline
Training
CUMULATIVE OCCURRENCES
0
10
20
30
40
50
60
70
80
90
100
110
7-76
OBSERVATION BLOCKS
5-77
KEY
TOKENS
TYPES

Figure 87

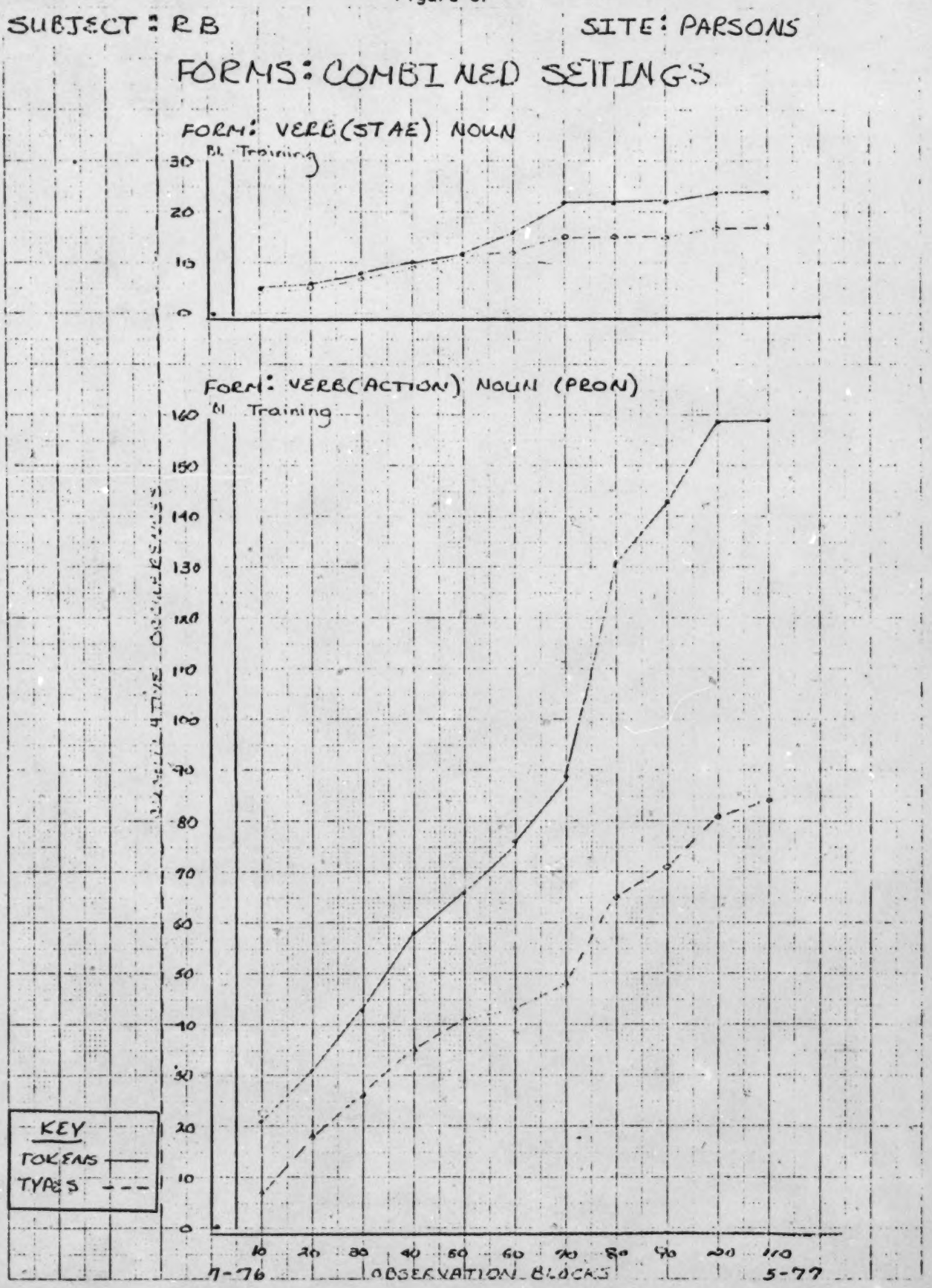
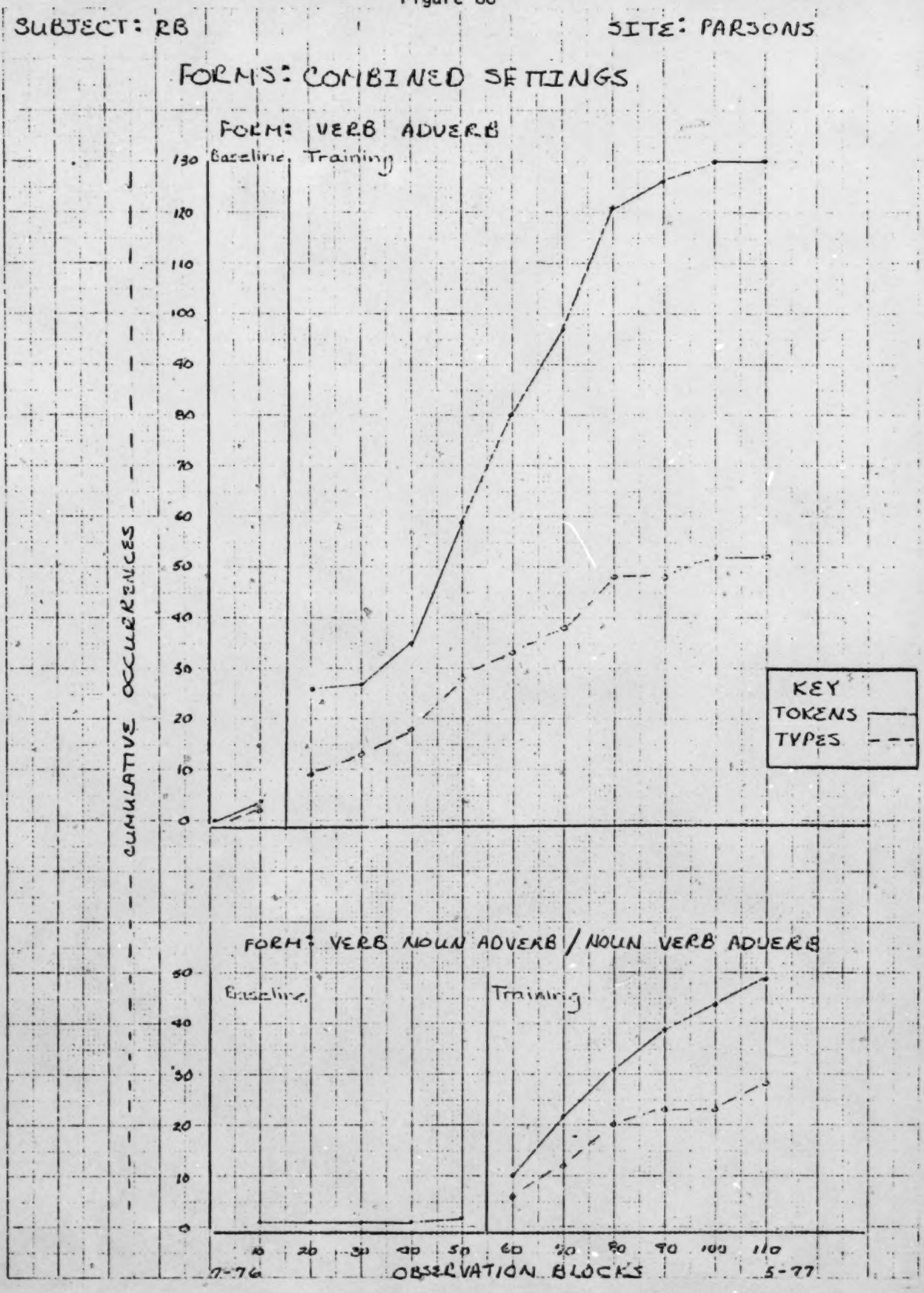

SUBJECT: RB
SITE: PARSONS
FORMS: COMBINED SETTINGS
FORM: VERB(STAE) NOUN
BL Training
30
20
10
0
FORM: VERB(ACTION) NOUN (PRON)
BL Training
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
KEY
TOKENS
TYPES
10
20
30
40
50
60
70
80
90
100
110
7-76
OBSERVATION BLOCKS
5-77

Figure 88


SUBJECT: RB
SITE: PARSONS
FORMS: COMBINED SETTINGS
FORM: VERB ADVERB
Baseline
Training
CUMULATIVE OCCURRENCES
KEY
TOKENS
TYPES
FORM: VERB NOUN ADVERB / NOUN VERB ADVERB
Baseline
Training
OBSERVATION BLOCKS
7-76
5-77

Summary

R.B. showed moderate to high generalization of all trained structures. Generalization first occurred shortly after training was initiated and increased as more complex syntactic structures were trained. Rate observations indicated that R.B. was given many opportunities to use language and received fairly high levels of consequation. Increases in test scores showed the most growth in the areas of articulation and vocabulary acquisition.

Parsons Discussions

The individual findings presented in the results section are summarized in the table below.

Insert Table 17 About Here

As shown in Table 17, an average of four structures were trained for subjects at the Parsons setting. Longitudinal generalization observations were conducted on each subject for an average of 13 months. Good to moderate rates of generalization were observed for approximately 60% of the trained structures. On another 22% of the trained structures, the child used the trained form, but the data suggested that she/he may have acquired the form independently in the natural environment, and not necessarily as a direct result of training.

Despite the relatively strong generalization data, the mean lengths of most of the subjects' utterances (MLU) did not increase substantially, although in several cases small increases were found. Most subjects showed advancements during the training period in terms of scores on the standardized assessment tests.

The Parsons' structural generalization data were encouraging. They suggested that the Stremel and Waryas training program, which was designed and modified for this specific type of setting and population, was effective from the standpoint of syntactic generalization to the natural environment. Where generalization failed to occur, the addition of sequential modification procedures was sufficient to facilitate it. To implement a sequential modification, a therapist introduces direct training in the intended generalization setting until it occurs. The results following such modifications are not generalization, but direct training effects. However, the use of this procedure in one setting may facilitate the subjects' generalization to other environments where no sequential modification occurs. Sequential modification was necessary with only two subjects.

Subjects trained on manual sign communication generalized as well as subjects trained in vocal communication. At least in this specialized environment (where the teachers and adults knew and communicated using manual signs) the manual sign training was as effective as the more standard vocal language training. There were some systematic differences in terms of specific vocabulary, but not in generalization of syntactic structures.

Table 17

Summary of Results for Parsons Subjects

Subject	Modality	Length of Obs	Structure	Generalization	Complexity	Assessments	Comments
K.M.	Signs	18 mo.	V VN P State V P N/P V N/P	Generalized Generalized Generalized Generalized	No Change	PPVT +1.3 yrs Houston +6 mo. Vocabulary - 222 words	
W.P.	Signs	10 mo.	P/N V V P/N P/N VN	Acquired Acquired Generalized	MLU 1.32→1.42	PPVT +2 yrs. Houston +4.4 Vocabulary - 217 words	
J.R.	Signs	8 mo.	V VN P/N V N	No Effects No Effects No Effects	Change only in setting where sequential modification was instituted (1.08→2.36)	PPVT - No change Houston - No change	Profound hearing loss
	Signs	19 mo.	VN	Generalized Acquired	No Change	PPVT +4 mo. Houston +8 mo.	
M.G.	Signs	19 mo.	VN P State V N	Generalized Acquired	No Change	PPVT +4 mo. Houston +8 mo. Vocabulary - 160 words	
C.W.	Vocal	24 mo.	V P/N	Generalized	MLU 2.04→2.14	PPVT +5 mo. Houston +1 mo. Vocabulary - 555 words	
C.R.	Vocal	10 mo.	V P/N P/N V P/N	Generalized Generalized	Very slight increase during final weeks of training	PPVT +2.3 yr. Houston +5 mo. Vocabulary - 39 words	

Table 17 Continued

Subject	Modality	Length of Obs.	Structure	Generalization	Complexity	Assessments	Comments
T.B.	Vocal	7 mo.	P Articles Wh Q Is/Are Q	Generalized Generalized Generalized Sequential Modification	MLU 2.67→3.13	Vocabulary - 840 words	
R.B.	Vocal	9 mo.	V P/N P/N V V Adv P/N V P/N VN ADV/N V ADV NV (PREP) (MOD) N	Generalized Generalized Generalized Generalized Generalized Generalized	MLU 2.0→2.6	PPVT +1.9 yr Houston +2 mo. Vocabulary - 435 words	

abilities than on productive ones. They were typically low rate speakers and participated in many fewer social interactions than their normal peers. When rate was systematically increased, as in the mand-model procedure, or when rate increased with socialization in the preschool setting, there were noticeable increases in the children's productive language. For language delayed children, performance variables, the component social interaction skills and an appropriate rate of verbal interaction, may be the critical targets for language intervention. Because they are able to acquire new information from the environment, interventions that served to increase their contact with naturally occurring reinforcers may be sufficient and possibly necessary to facilitate their development.

In this presentation of results, subjects have been categorized as showing generalization, acquisition, or no effect resulting from training. Determining the sufficiency of generalization is more difficult than such a categorization would indicate. Across children and specific structures, rates of generalized use varied widely. There were no specific criteria for sufficient generalization. If a clear change in rate between baseline and training conditions was discernable, the structure was considered generalized. There are many environmental variables that influence rate of display of any particular structure, but some across-setting criteria would be most useful to the therapist seeking to determine the adequacy of training or generalization. Future descriptive and experimental research should consider this issue empirically.

These results have several implications for applied comprehensive language training. First, training should be focused on language that will be functional for the child. Students of varying abilities may require different foci in training. Second, the use of probes and naturalistic observations to measure generalization outside the training setting is necessary because training data alone are not sufficient indicators of the child's actual use of trained structures. Third, multiple exemplars of syntactic structures should be used. The number of examples should be determined by the student's performance on probes with novel examples. More severely delayed children will require many examples. Fourth, generalization is influenced by the opportunities and support for language display offered in a given environment. Optimal generalization requires a supportive setting. Fifth, although students of all levels benefit from intensive training, language programs probably cannot teach any child everything needed for competent communication. The training goals for an individual should be in line with his/her developmental level. Some training goals, such as increased interaction with peers, may not require or be achieved by one-to-one training on a specific language curriculum. Auxiliary programming that focuses on related social or academic skills will be needed to achieve these goals.

Additional suggestions and implications of the findings from all aspects of the research program are discussed further in the final section of this report.

III. ECOLOGICAL DESCRIPTIVE STUDIES

The effects of environmental variables on children's language acquisition has been a focus of considerable recent research. Much of the current emphasis has centered on the influence of parents', siblings', and peers' language on young children's language acquisition. Only a few investigators have studied the verbal interactions that occur in the environments of young handicapped children. The primary focus of research reported in this section was the language environments represented in integrated or mainstreamed preschool classrooms. Abstracts of the studies reported here can be found in Appendix 6.

Mainstreaming, or the integration of handicapped children into classrooms largely composed of nonhandicapped children, is becoming an increasingly common educational practice. A similar practice, integration of nonhandicapped children into classrooms of handicapped children, sometimes called "reversed mainstreaming," is also increasing in popularity. There is little empirical basis for mainstreaming, in either form, but the theoretical basis for these movements is that the handicapped children will benefit from observing and interacting with the nonhandicapped children. Research conducted in the present project was designed to investigate some of the theoretical assumptions underlying mainstreaming.

The studies can be divided into two areas: those that deal with child-child or peer interaction, and those concerned with teacher-child interactions.

Peer Interaction. McQuarter, Rogers-Warren, and Warren (I) compared the verbalization rates, verbal initiations, and responsiveness to questions from peers, exhibited by five normal children in an integrated classroom with the behaviors of ten language delayed preschoolers in the same setting. Data were collected during 10 15-min periods across three months. Rates of target verbal behaviors by the five normal model children were also compared with levels observed in five normal children in a regular non-integrated preschool classroom. The normal children displayed higher rates than the delayed children in all three categories. The rates of verbalization by the two groups of normal children were similar, except that the normal children in the non-integrated classroom directed a far greater percentage of their verbalizations to their peers than either the language delayed or normal children in the integrated classroom. In the integrated classroom, normal children tended to talk to other normal children or to teachers.

Paul (IV) measured the frequency of peer-directed verbal interactions in a reverse mainstreamed preschool classroom for language delayed children. Language from and to peers was recorded during a daily 15-min observation using a 10-sec interval code. She found that during the first half of the year the children tended to talk with "same level" children. During the second half of the year, children talked more frequently and there was more talking across levels of ability. She hypothesized these differences may have been due to increased familiarity of the children and improvements in language ability.

In a follow-up study, Paul (V) compared rates of peer-directed talking in five different preschool classrooms. Ten samples were collected in each classroom. Normal children in two daycare settings talked more frequently to their peers than did normal children in two preschool settings. Three normal children in a classroom with seven language delayed children had lower rates than did normal children in other settings. Two language delayed children who were concurrently enrolled in two settings talked more frequently to peers in their normal daycare classroom than they did in their classroom for language delayed children. These results suggest that language delayed children in a classroom with normal children (mainstreaming) may demonstrate more nearly normal levels of verbal interaction, than they do in a classroom enrolling mostly language delayed children (reversed mainstreaming).

These two studies (Paul, IV, V) provided a description of children's peer verbal interaction in various contexts. A natural extension of this work was to attempt to increase the verbal interactions of children.

Paul (VI) recorded and transcribed 164 10-min dyadic play sessions which included: (1) two normal children; (2) two language delayed children, or (3) one normal and one delayed child. Behaviors categorized as seeking and providing information, recruitment of the listener's attention, and reinforcing the speaker were compared during baseline, an intervention to increase rates of talking, and an intervention to teach particular conversational skills. Interactions between normal children were characterized by high rates of verbal behavior in all three categories. In conversations between normal and language delayed children, there were high rates of recruitment of the listener's attention, particularly by language delayed children, and a corresponding decrease in the other two categories. As a result of intervention, rates of content-relevant utterances increased in conversations involving normal and language delayed children.

In a subsequent study (Paul, VII) the form and function of questions were analyzed in freeplay sessions involving pairs of normal and language delayed preschoolers in the same dyadic contexts as Paul (VI) but including a fourth context in which a normal and language delayed child, who had received special tutoring in question asking, were paired. Normal children asked the most questions when paired with normal children, however, the rate of questions was similar across the four contexts. Children answered about one-third of their own questions. "What" questions, yes/no, and tag questions were the most frequent in the normal-normal context and in the tutored context. Normal children also asked more "where" and "when" questions and questions designed to seek information or report. Test/game questions and clarification questions were more frequent when language delayed children were included in the dyad. Special question tutoring did not result in a distribution of functional use which resembled that of the normal-normal context.

Paul (VIII) provided an analysis of two ways of grouping preschoolers. Homogeneous triads composed of normal or language delayed children

were compared to heterogeneous triads composed of two normal and one language delayed child. Videotapes of the group interactions were scored for: number of initiations, number of responses, who talked to whom, level of reference, requests for peer behavior and contingent response. Results showed that the normal children talked at high rates in both groupings and the language delayed children talked very little. Two of the three language delayed children increased their rate of talking in the heterogeneous grouping and this increased rate was carried over into later homogeneous groupings.

Teacher-Child Interaction

In addition to peers in a classroom, the teacher plays an important role in language instruction and as a source of verbal interaction.

A study by McQuarter, Rogers-Warren, and Warren (II) investigated how much and in what way teachers talk to normal and language delayed children in their integrated (reverse mainstreamed) and nonintegrated classrooms and how much the children talk to their teachers. Ten 15-min observations were made in freeplay with a teacher-child ratio of one to five. Language delayed children responded to questions from their teachers at a much lower rate than their normal peers. Normal children talked primarily to teachers and relatively little to handicapped peers. Rates of teacher verbalizations to both types of children in the integrated classroom were very similar in terms of their total verbalizations, questions, and instructions to each group. Further, these teachers' rates were very similar to the rates displayed by teachers in the nonintegrated classroom.

McQuarter et al. compared rates of verbal interaction between adults and children of differing language abilities in four settings. The first setting was a university preschool classroom with three teachers, seven language-delayed children and three normal children. The second was a classroom in an institution for the moderately retarded which included eight pre-adolescents and two adults. The third was a classroom of two teachers and eleven severely and profoundly retarded adolescents in an institution. The fourth setting was a preschool classroom of 13 Down's syndrome children. Subjects were observed during a period in which two children and an adult interacted. Each setting was further divided into a structured and an unstructured situation. Across all settings, structured activities doubled rate of adult verbalizations as compared to unstructured activities. Adults' question-asking behavior increased markedly during structured periods. Child response rates increased as teacher verbalizations increased, however, child initiations were not appreciably increased by structured activities.

Rogers-Warren made an ecological analysis of two wards of a state institution for the severely and profoundly retarded to determine how number of staff and type of activity of residents and staff members affected the activity level and inappropriate behavior of the children. Twenty-eight

children in two wards and their respective staffs were observed ten times in each of three activities; freetime, program, playground. Across all three activities, the amount of inappropriate behavior decreased as activity level increased. That is, as the children engaged in more interactions with peers and materials, the amount of inappropriate behavior decreased. Inappropriate behavior also decreased and activity level increased with an increase in staff present. Small child-staff ratios decreased inappropriate behavior and increased appropriate child activity.

Longhurst and Brown described the nondemanding consequent events following the verbalization/vocalizations of three moderately-to-severely developmentally disabled preschool children. Subjects were three male children and two teachers in a preschool classroom for developmentally disabled preschoolers. Fifteen 15-min observations were conducted during a period when a teacher and the target child were engaged in an activity known as "tablework." Analysis of teacher-child interaction data revealed that less than 37% of the children's utterances were consequated by teachers. For all three children, the most frequently occurring category of consequences was commentary by the teachers. Teachers consequated the utterances of the two less verbal children more often than the utterances of the most verbal child. Expansions of the children's verbalizations comprised 3% or less of the total number of consequent events produced per session by teachers. The teachers produced no simple or complex expatiations as consequences to the children's verbalizations. These data suggest that the vocalizations/verbalizations produced by these children were consequated relatively infrequently and seldom received consequences that would encourage them to verbalize more.

Longhurst and Schraeder conducted a study designed to describe interrogations addressed to four developmentally disabled and four nondisabled preschool children by their two teachers in a reverse mainstreamed classroom. There were relatively small differences in teacher interrogations to disabled and nondisabled children. Interrogative styles to both groups of children could be further adjusted to more appropriately address the language capabilities of the children. By analyzing children's responses to specific adult input, it is possible to recognize what types of adjustment should occur. Direct intervention targets concerning adult's linguistic input to children are readily identifiable when this type of observation is made.

An investigation by Longhurst and Livingston examined the verbal interactions of two preschool teachers in a reverse mainstreamed classroom of four nondisabled children and seven disabled children. Teacher language was analyzed according to 19 variables. Child speech was classified into five categories, including unintelligible utterances. Interaction patterns were analyzed along three main parameters: (1) similarities and differences in teacher speech according to linguistic level of the child; (2) inter-teacher differences within each child level;

and (3) similarities and differences in child speech according to linguistic level. As was expected, the two groups of children differed markedly in their speech and language performance in the classroom. It was concluded that the two groups of children were exposed to a different linguistic environment in the classroom. Nondisabled children received more total teacher utterances, more requests for verbal responses, and more spontaneous conversation than disabled children. Behavior requests, directives and instructions were more frequent with disabled children. Ratios of teacher-to-child utterances were substantially higher for the disabled children. The nature of these differences suggest that the child's behavior directly influences his language environment.

Summary. The results presented by Rogers-Warren suggesting that the traditional belief that small child-teacher ratios are beneficial, is a valuable and valid one; however, additional research analyzing why increasing the number of staff alters behavior is necessary. Without increasing the investment in more staff it may be possible to teach a small staff to provide more structured activities and distribute their time across children within a setting to achieve the same result. McQuarter's results suggested that all levels of handicapped children verbalize more when they engage in structured activities.

The findings of McQuarter, Rogers-Warren, and Warren suggested that simply integrating children will not produce the desired effects assumed by the advocates of mainstreaming. Normal children integrated into a classroom for language delayed children directed most of their talking to the teachers and their normal peers rather than to the language delayed children or their teachers.

Generally, the findings of Paul (IV, V, VI, VII, VIII) suggested that when normal and language delayed children are integrated beneficial peer-directed verbal interactions occur for the delayed child. However, her research also suggested that the benefit for a normal child in a reverse mainstreamed classroom may be considerably less. When children are integrated the beneficial effects can be increased by training them to interact. Although tutoring in question-asking for the language delayed children did not have the desired effect, this is certainly an area that needs additional research since most verbal interaction is precipitated by questions. Varied groupings of normal and language delayed children did not dramatically facilitate social language use by language delayed children; however, Paul (VII) did suggest that the effect may be more positive if the intervention was more obtrusive and continued over a longer period of time.

The research of Longhurst and his colleagues was directed primarily to the role of teachers in an integrated preschool classroom. These results suggested that the teachers seldom consequated the child's vocalizations or verbalizations and they seldom used the normal children as models. The interactions of the teachers with normal and developmentally disabled to the normal children. Teachers used more directives and instructions and fewer expansions and expatiations with disabled children. Teachers

tended to answer their own questions, and ask questions that could not possibly receive an answer when interacting with the disabled group. The teachers increased the redundancy of their vocabulary when talking to disabled children. Generally, this research suggests a number of ways that teachers could improve their interaction skills that may facilitate the language learning of their children. The intervention with preschool teachers to improve their interaction skill remains to be done.

The research reported here was designed to investigate the ecology of learning environments of handicapped children. Generally, this research should be taken as support for the mainstreamed or integrated educational model. However, these studies also suggest that the success of the model can be enhanced by providing interaction training to the teachers and pupils involved.

Studies Completed

Longhurst, T.M., & Brown, P. Responses to vocalizations and verbalizations of developmentally disabled preschool children. Unpublished manuscript, Kansas State University, 1978.

Longhurst, T.M., & Elmore, J. Quantity and quality of teachers' vocabularies addressed to developmentally disabled and nondisabled preschool children. Unpublished manuscript, Kansas State University, 1979.

Longhurst, T.M., & Livingston, R. Teacher verbal interactions with developmentally disabled and nondisabled preschool children. Unpublished manuscript, Kansas State University, 1979.

Longhurst, T.M., & Schraeder, J. Teachers' interrogations to developmentally disabled and nondisabled preschool children. Unpublished manuscript, Kansas State University, 1978.

McQuarter, R., Rogers-Warren, A., and Warren, S. Normal and delayed language development: A quantitative analysis. Unpublished manuscript, University of Kansas,

McQuarter, R.J. Environments of the language delayed: Some comparisons and their implications. Unpublished manuscript, University of Kansas.

Paul, L. (A) Peer directed verbal interactions in a classroom for language-delayed children. Unpublished manuscript, University of Kansas.

Paul, L. (B) Context factors influencing peer directed verbalization rates. Unpublished manuscript, University of Kansas.

Paul, L. (C) A comprarative analysis of communication between normal and language delayed children. Unpublished manuscript, University of Kansas.

Paul, L. (D) The form and functions of questions in child-child conversation. Unpublished manuscript, University of Kansas.

Paul, L. (E) Social language and assembly effects. Unpublished manuscript, University of Kansas.

Rogers-Warren, A. An analysis of two naturally covarying behaviors: Activity level and inappropriateness. Unpublished manuscript, University of Kansas.

IV. EXPERIMENTAL ANALYSES

The process of training communication skills in language delayed children encounters its greatest challenge in the area of generalization. To be truly effective, a language training program must train the child to use relevant language behaviors across different conditions which include: 1) behaviors, 2) persons, 3) settings, 4) time, and 5) contingencies. Yet time does not allow programming for each trained behavior across all these conditions. Generalization programming must become a reality if the child is to learn to communicate effectively in his natural environment. Measurement of programmed language acquisition and systematic evaluation of training procedures are necessary if generalization is to be realized.

Stokes and Baer (1977) conducted a comprehensive literature review of applied behavior analysis studies relevant to generalization. They concluded there were eight experimentally verified techniques directly related to a technology of generalization. The experimental application of five of these techniques was conducted within this project. Research studies have been completed examining the effects of:

1) Using sequential modification,

2) Training sufficient exemplars,

3) Training loosely,

4) Using indiscriminable contingencies, and

5) Programming common stimuli.

Sequential Modification. Warren, Baxter, Anderson, Marshall, and Baer trained nine subjects to ask, "What's that" questions when novel stimuli were presented. They assessed the durability of the trained question responses to novel stimuli two months after training criterion was met. The results showed that maintenance of the trained behavior did not result from therapeutic interventions. Only two of the nine subjects displayed maintenance of the question-asking behavior. Two of the remaining seven subjects were retrained by providing a brief model of the appropriate behavior. The other five required a very short perior of retraining within the original training condition. These data suggested that short training reviews may be necessary to insure the durability of trained responses.

Training Sufficient Exemplars. Anderson investigated the number of response exemplars necessary to train productive labelling. He initially selected six object classes that were common to the subject's daily living environment, with six exemplars chosen to represent each group. Anderson's study included three experimental tasks: (1) a match-to-sample task, designed

to determine the subject's nonverbal classification of experimental stimuli prior to productive labelling training; (2) a productive labelling task, used to train productive labels for some examples of a class and determine the extent of generalization to nontraining examples within the same class; and (3) a receptive labelling task, designed to assess nonverbal classification of experimental stimuli prior to productive labelling training and generalization resulting from the productive training.

Anderson found that even though his subject could demonstrate match-to-sample skills with object exemplars, he failed to demonstrate the same classification skills in productive labelling. The number of examples sufficient to produce generalization across classes of responses varied. Anderson's data suggest that one method of programming generalized labelling is to train sufficient examples. Concurrent training seemed to facilitate the emergence of generalization. His data are consistent with other studies that showing that concurrent training rather than serial training results in greater generalization. Productive labelling training did not produce systematic changes in the correct responding within the receptive modality.

A sufficient-response-exemplars demonstration of programmed generalization across communication functions was conducted by Stremel-Campbell (I). Two severely retarded subjects were initially trained to use "action-object" responses to untrained communication functions requesting peer action and describing action. The results showed that utterances or structures trained to express one communication function did not insure generalization to untrained functions. The number of responses used to express different functions increased as each function was trained. The number of training trials necessary to train each successive function decreased. Training sufficient communication functions seems to be necessary if the child is to use language to represent different communication functions.

In another study, Stremel-Campbell (II) used forty examples of action-object structures to teach two vocal subjects and two manual signing subjects the generalized use of action-object structures. Verbatim data collected in the nontraining, classroom setting provided a measure of the use of both trained and untrained combinations of action-object structure across subjects. All subjects showed generalized use of both trained and untrained utterances in the classroom setting. However, the degree of generalization of trained and untrained combinations varied between the speech subjects and the signing subjects. Signing subjects had a fairly high frequency of trained combinations and only minimal use of untrained combinations; whereas, the verbal subjects showed lower frequencies of trained combinations and higher frequencies of untrained combinations. The data suggest that different generalization programming may be necessary for subjects receiving manual signing training.

Training Loosely. Campbell showed that programming a "loose training" strategy resulted in the generalization of "is/are" across settings and time. Campbell used a procedure described as "contextual initiation" that included: a) concurrently conducting language training within the

context of an academic training task, and b) establishing a functional reduction in stimulus control by permitting the subject to select his own environmental stimulus and initiate a response to that stimulus. Two subjects were trained to use "is/are" responses in Wh questions, yes/no questions, and statements in the classroom setting. Probes were conducted in the freeplay setting to measure the generalization of "is/are" usage across a nontraining setting and across time. Both subjects demonstrated correct use of "is/are" structures within the freeplay setting when the training procedure was initiated. The subjects continued to use the trained language behaviors across time.

Using Indiscriminable Contingencies. Stremel-Campbell and Campbell investigated the use of indiscriminable contingencies as a programming strategy to facilitate the generalization of nouns to a nontraining setting. Four severely retarded subjects were trained to use manual signs in a training setting. Four consecutive sets of five nouns were consecutively trained for a total of 20 training items. Two of the subjects received a maintenance training condition with an FR 2 schedule of reinforcement after each training set had reached criterion. The two remaining subjects did not receive the maintenance condition until the fourth training set was trained. For these subjects, training on each set was terminated once criterion was met and the next set was trained. Results of this investigation showed that the subjects demonstrated continued generalization of the noun responses only after the FR 2 schedule (maintenance condition) was initiated. When the maintenance condition was discontinued for two of the subjects, decreases in generalization occurred. These results indicated that the use of indiscriminable contingencies as a generalization programming strategy was effective in establishing the durability of generalization. Varying schedules of reinforcement (FR 3, FR 5, etc.) may need to be introduced systematically to determine if more durable generalization can be achieved.

Programming Common Stimuli. Stremel-Campbell (III) investigated the effects of programming common stimuli across structures and across settings Three nonvocal subjects were trained to use "action-object" and "agent-action" responses during training. Verbatim data were used to assess the generalization of those trained responses to untrained "agent-action-object" responses. All subjects showed immediate generalization to the untrained longer structure. These data suggest that each different structure may not have to be trained once components of that behavior have been trained. Those structures were also used to determine the generalization of trained responses to common settings.

The subjects were trained to use "action-object," "agent-action," and "feature-object" utterances during the lunch period. Generalization to nontraining, but common settings was assessed during breakfast and dinner. The results for the three subjects varied. One subject showed generalization to the similar, but nontraining settings. The other two subjects required additional programming of common stimuli. For one subject, the introduction

of the trainer as an observer during breakfast was sufficient to produce generalization across both nontraining settings. The third subject required training on one structure within the common setting before generalization of all structures occurred within that setting.

Summary. Five generalization programming techniques were experimentally investigated within the course of the grant. The five general programming techniques included:

1) Using sequential modification,

2) Training sufficient exemplars,

3) Training loosely,

4) Using indiscriminable contingencies, and

5) Programming common stimuli.

The series of research studies examined the effects of specific techniques within the generalization programming categories. These effects were examined both within the language training setting and across nontraining settings. The subjects that participated in the studies were moderately to severely retarded individuals who resided in institutional settings. The subjects included individuals who were trained to use language through both speech and manual signing modalities.

The results of these studies indicated that the effects of specific generalization programming may vary across different subjects, language modalities, training content, and settings. The degree and durability of generalization across subjects and specific techniques needs further examination to conclude a definition of adequate generalization. In summary, the data suggest:

1) Maintenance reviews may be necessary for some children if the target behavior is not subsumed in the next level of programming.

2) Training sufficient examples of stimuli will facilitate generalized responding.

3) Training sufficient communication functions may be necessary if the child is to learn to use language to communicate various functions.

4) Additional training across similar classes of behaviors that include different response topographies may be necessary.

5) Additional programming of sufficient exemplars may be necessary to train signing children a larger response repertoire.

6) Concurrent training rather than serial training results in greater generalization.

7) Establishing a functional reduction in stimulus control facilitates generalization to nontraining settings.

8) Using intermittent schedules of reinforcement directly after training is completed promotes the durability of generalization.

9) Training common components of a more complex structure may facilitate acquisition of that structure.

10) Programming different properties of common physical stimuli may be necessary if the child is to generalize to nontraining settings.

The data collected in the course of the studies provide some direct implications for modifying intervention programs specific to each individual child. However, the studies also demonstrate that additional empirical work is necessary to determine the optimum generalization programming necessary for generalized use of language both across time, settings and persons. Additional research should include:

1) Replications of the previous studies across different subject groups.

2) Replications of the previous studies across a number of different language structures.

3) Studies that investigate the optimum combination of programming techniques, and

4) Studies that determine if specific programming techniques facilitate greater generalization for certain individuals or groups of individuals.

Studies Completed

Campbell, C.R. Programming "loose training" as a strategy to facilitate language generalization.

Stremel-Campbell, K. Differences in generalization between speech and signing subjects.

Stremel-Campbell, K. Programming common stimuli across training structures and settings.

Stremel-Campbell, K. Training sufficient communication functions.

Stremel-Campbell, K., & Campbell, C.R. Programming maintenance training as a strategy to facilitate sign generalization to a non-training setting.

Warren, S.F., Baxter, D., Anderson, S., Marshall, A., & Baer, D.M. The generalization and maintenance of question-asking behavior by severely retarded children.

V. ENVIRONMENTAL INTERVENTION STUDIES

Both linguistic competence, knowledge of the rules and vocabulary necessary to label environmental events, and social communicative behavior, or performance demonstrating underlying competence, are necessary for functional communication. Language delay may be described as absence of linguistic competence, social performance of language skills, or both. The children studied in the longitudinal analysis of generalization were enrolled in language training as a means of insuring acquisition of the linguistic competence necessary for communication. However, individual language training may not be sufficient to generate improvements in the child's actual communication. Failure to generalize trained forms across environments and persons indicates the performance aspect of the communication repertoire has not been acquired. The child's actual communication depends upon performance of trained skills, and if performance does not occur as an immediate result of training, interventions to support performance are required.

Nine studies investigating procedures for increasing communication in natural environments were carried out. Abstracts of the studies reported here can be found in Appendix 8. Each study had as a part of its goal to increase the rate of verbalizations by subjects in a particular setting. Although the persons to whom language was directed, the methods by which rates of display were increased, and the extent to which the intervention was intended to facilitate generalization of particular training forms varied, these studies shared numerous common assumptions.

The first assumption was that the child's rate of language use will depend to a great extent upon the behavior of others in the immediate environment. The longitudinal analysis of rates of language by target subjects and of language directed to target subjects by adults and peers when viewed in conjunction with the analysis of generalization across settings, clearly suggests that adult speech is a primary determinant of the rate of child speech and in turn, rate of child speech is a major factor in the level of generalization. When adults frequently request language from children, children speak more often. The higher the rate of appropriate, directed language, the more likely the child is to generalize newly-trained forms. Adults may be the single most important component of any setting because they can structure the environment to provide occasions and contingencies for child speech. To a lesser extent, peers are also important to language display by language learning children. A competent peer provides many of the same stimuli and responses for the child that an adult does; however, children may need more conversational and linguistic skills to interact with peers because peers are not as adept at structuring interactions.

The second assumption, that a reasonable rate of language display is a feasible goal, is implicit in the preceding argument. Rate has been shown to be highly correlated with complexity of child speech (Hart & Risley, 1974; Nelson, 1973). Furthermore, an appropriate rate of speaking promotes the

child's participation in incidental learning. The child who is verbally responsive, answers questions, acknowledges greetings, comments on the environment, provides adult listeners with opportunities to provide specific feedback about the correctness or appropriateness of the child's language, and signals, by the verbalization, moments when his attention is focused and modeling or specific encoding might be salient and effective. The child's participation in conversations suggests that he is an active participant in the learning process and that teaching might reasonably occur.

Participation in social interaction, as indicated by an appropriate rate of verbalization, may also serve to introduce the child into the community of natural reinforcers for language by demonstrating to the child the functions of language. When a child verbalizes, things are likely to happen: an adult attends, peers reply, the child's speech is interpreted as having an intent or meaning, a request for further language or an interpretation of the child's meaning is presented, services are provided. Although the consequences may vary, language is consequated typically with verbal replies or nonverbal events. These contingent events reinforce the display of the entire class of linguistic behaviors, and may provide sufficient contingencies to shape specific types of utterances, such as requests. The child who verbalizes at a reasonably high rate has many opportunities to learn about the functions of language by observing the consequences of his verbalization. In turn, these consequences, assuming they are reinforcing, support further language, ideally more complex, refined utterances that can obtain particular consequences specified by the child.

The interaction of competence and communicative performance may be both cause and effect of language delay. Many subjects evidenced social-developmental, as well as, language delays. Their interactions with adults and peers were less frequent, briefer, and less successful than normal children even when language was not required specifically. Because they did not participate in social interactions, they had fewer opportunities to learn about language, to practice language, and to be taught additional language. Thus, the language deficits that limited their interactions, also limited the acquisition of new skills.

The intervention studies conducted were designed to increase rates of subjects' verbalizations as a means of normalizing the subjects' interactions. Normalization in most instances simply meant aiding the subject in becoming a participant in social-communicative interactions. Three strategies for increasing social communication were explored: adult prompting of child speech, environmental arrangements to facilitate interaction, and facilitating peer interaction. Studies investigating each of these strategies are discussed below.

Increasing Child Verbalizations: Using Adults as Intervention Agents. A direct procedure for increasing children's rates of verbalizations is to increase systematically adults' demands for language. Adult demands most frequently take the form of questions, but other specific forms such as mands

or instructions to verbalize (e.g., "Tell me what you want,") can be equally effective in eliciting verbal replies. Four studies (Rogers-Warren & Warren; McQuarter, Warren & Rogers-Warren; Longhurst & Shank-Andersen; and Rimell & Warren) examined the effects of increasing teacher verbalizations by requesting a verbal reply on the rates of verbalization by children receiving language training. In each study, several children and their teachers were observed during a baseline period and levels of teacher verbalizations and child initiations and responses were determined to be lower than desirable. In two studies (Rogers-Warren & Warren, and McQuarter et al.), language delayed children's rates of verbalizations were compared with normal peers in the same setting and found to be significantly lower. Teacher questions and mands were directed to the language delayed subjects at about the same rates as they directed verbalizations to normal children; however, the language delayed subjects were significantly less responsive to teachers' demands. In a third study, Longhurst and Shank-Andersen, teachers' rates of questions to developmentally delayed preschoolers were lower than their rates of verbalization to the normal children enrolled in the same classroom. The fourth study assessed teachers' rates of questioning in an institutional classroom for severely retarded students. No normal subjects were available for comparison.

All four studies used multiple baseline designs to systematically increase teacher verbalizations. In all cases, teachers were able to successfully alter their rates of verbalization and children showed concommitant increases in verbalizations during the intervention period.

Longhurst and Shank-Andersen trained three teachers to increase their questions directed to nine children during snack, music, and circle activity periods by modeling and instructing the teachers during a weekly staff meeting. The target children showed moderate increases in rate. Changes in both teacher and child verbalizations were maintained as noted in a probe conducted in each activity four weeks after the completion of the intervention phase. A second probe, conducted six weeks after the intervention, showed maintenance during one activity, circle, but a decline in both teacher and child behaviors in the other two periods, snack and music.

Two studies used a modified version of the Hart and Risley (1974) incidental teaching technique to increase child verbalizations. This technique consisted of prompting children to request materials and services, modeling a response if the child was unable to produce an appropriate spontaneous reply, and then, providing teacher attention, praise, and the requested materials immediately following the child's spontaneous or imitated verbalization. Rogers-Warren and Warren increased verbalization rates for three children during a freeplay period and subsequently found that generalization of newly-trained forms increased beyond the level predicted by a simple increase in rates of verbalization. Both teachers and children maintained higher levels of verbalization when a probe was conducted six months after the end of the intervention. McQuarter, Warren, and Rogers-Warren increased overall rates of child verbalization by sequentially requiring subjects to provide one-word responses, then two or more word

responses to obtain materials and teacher attention. The complexity of the subject's speech increased, generalization from training again rose beyond the levels predicted by a simple rate increase, and two of three subjects generalized to a nontraining setting. Teacher rates of question asking and manding were then systematically decreased to levels comparable to those obtained in interactions with normal children. Two of three subjects maintained high levels of verbalization when the procedures were discontinued. A third subject declined to a lower, but higher than baseline, rate of talking.

Although the fourth study (Warren & Rimell) increased three institutionalized subjects' rates of verbalization, its main goal was to examine the side effects or covariations resulting from systematically increasing teachers' questions to the target children. When teachers increased their questions, child verbalizations increased. No consistent pattern of covariations among teacher behaviors or between child and teacher behaviors was evident although certain teacher and child behaviors covaried for individual subjects. The results suggested that there may be unintended positive side effects, such as increases in positive consequences for language display, following an intervention to increase a particular teacher behavior; however, the side effects may be capricious and unpredictable across child and teacher subjects.

Environmental Arrangements to Facilitate Language Display. Two studies (Halle, Marshall, & Spradlin, and VanBiervliet, Spangler, & Marshall) investigated alterations in the dining hall procedures in a state institution as a means of increasing retarded residents' language use in that setting. The particular advantage of the two environmentally-based facilitation techniques was that they required considerably less staff training and support for high rate staff behavior to elicit language from the residents than the studies reported in the previous section on adult-based interventions. This advantage is especially important in settings where staff have other primary care responsibilities or are unlikely to be sufficiently skilled or motivated to use direct intervention strategies.

Halle et al. increased children's requests for trays of food in the cafeteria line by instituting a 15-sec delay during which the attendant held a tray of food and waited for the child to request the food and by modeling the appropriate response if the child was unable to spontaneously request the tray. In a multiple baseline across six severely retarded residents, the delay, modeling, and contingent delivery of the tray immediately following the child's appropriate verbalization were used to increase mealtime requests. Following primary training at one mealtime, the introduction of the delay alone was sufficient to produce generalization to a second mealtime. Most subjects also generalized to new trainers and new settings without difficulty.

A second study by VanBiervliet et al. sought to increase general conversation during mealtimes in the same institutional setting. The intervention consisted of altering the dining procedures from cafeteria to family style. During baseline, residents picked up trays full of food and drink as they

entered the dining room. The intervention consisted of serving food family-style, thus requiring residents to request and pass food to each other during the mealtime. Residents also were required to clean up the table during the intervention condition. This straightforward change in the dining hall resulted in significant increases in subjects' staff and peer-directed verbalizations during mealtimes and increased the amount of time residents spent eating and socializing during the dining period. The obvious positive effects of the intervention were sufficient to prompt institutional staff to change from cafeteria to family-style dining in other settings in the institution. An interesting and important outcome of this environmental intervention was its simultaneous effects upon the target population (residents) and the attending staff. Without explicit instruction to do so , staff increased their attention and verbalizations to the residents during the experimental family-style dining period. Thus, this intervention utilized the strongest variable in the languagelearning child's environment, the adult speaker-listener, by manipulating a weaker variable, the arrangement of the setting.

Facilitating Peer Interaction. Children acquire much knowledge and social expertise through interactions with peers. The language delayed child may be further slowed in the process of social development by an inability to verbally interact with peers. In part, facilitating peer verbalizations is a problem of generalization across persons. However, the peer is a lessskilled conversationalist and social interactor than the adult teacher or parent. The problem is not simply generalization to a new person, but generalization to a person who provides significantly less support for language and who may have difficulty communicating his or her own intentions. Because peer interaction is an important force in the social development of children, three studies that attempted to increase peer verbal interactions were conducted.

In the first study (Paul I), three dyads of children enrolled in the Language Project Preschool were subjects. In each dyad, the more skilled speaker served as a peer "teacher" who initiated to the less skilled child and gave that child a token for each verbal response. In a multiple baseline design across dyads, the token exchange and experimenter prompts were introduced during a classroom freeplay period. Two dyads showed marked increases in overall verbal interactions and the third showed a small increase. However, the increased verbalizations were limited to those instances in which tokens were exchanged and the interactions were highly stereotypic. Experimenter prompts to the peer-teacher to initiate interactions and to the target child to respond were needed for most of the intervention phase to maintain the interactions. No generalization to periods when the tokens were not available was observed. Although there were quantitative changes in peer interaction as a result of the intervention the quality of these interactions was low and the results were not deemed satisfactory.

The results of the first study (Paul I.) prompted a further investigation of procedures to increase peer interaction. Three dyads composed of one normal and one language delayed child were subjects. During a 10-min daily play session outside the classroom, two procedures to increase talking

were introduced in a multiple baseline across dyads. The first procedure was to instruct the normal child to talk to the language delayed child. The second strategy was to present tokens to the normal child each time he or she spoke to the delayed peer. Neither strategy was sufficient to establish satisfactory levels of interaction between the children. Because the language delayed children rarely responded, the normal children quickly ceased to initiate to them. The presence of a reinforcer for their attempts to converse was not sufficient to support language when the peer did not respond.

These two studies (Paul I and Paul II) strongly suggested that conversational interactions between normal and language delayed children depended upon both children having certain conversational skills. Four skills were selected for training in a third study (Paul III): attending to the peer, asking and answering questions, and using attentional utterances. Skills were taught to both members of three dyads by an adult using modeling and reinforcement. Generalization of training was measured in nontraining dyadic sessions and a group play period involving all six subjects. Children were queried about their verbal interaction following each dyadic and group play session and were reinforced for true reports of peer interaction. All children showed modest and variable effects resulting from training. In general, the data were not conclusive but did suggest that further research on skill teaching for conversational interaction is needed. Of the three strategies for increasing peer interaction investigated here, the skill teaching approach appeared to have the strongest potential for actually improving children's peer interactions.

Summary. Three techniques were used to increase the rate of children's verbalizations in naturalistic settings. Direct adult intervention, including question asking, mands for verbalizations, models for verbalization and contingent reinforcement for verbalizations, was highly successful in increasing talking by preschool subjects of different ability levels. Some desirable side effects, such as increased complexity of child utterances and greater than expected increases in use of generalized forms, resulted from the increased demand for child language. Other, apparently capricious, side effects were noted in one study which sought to measure these covariations.

Two environmental facilitations of child language were investigated and shown to be useful, efficient techniques to increase rates of language display during mealtimes by severely retarded subjects. Both procedures were easy to implement and required minimal staff training and time to support child language.

A third set of studies attempted to increase peer verbalizations by language delayed children. Although all three studies showed some increases in rates of child-directed verbalizations, none of the procedures were entirely successful in increasing the quality of peer interaction to an appropriate level. Further research on teaching peer-directed verbalizations and increasing peer interactions is needed.

Taken together, these studies demonstrated that rates of verbalization and rates of generalized language display can be increased by a variety of techniques. Although the techniques are straightforward, they required considerable planning and, in most instances, a skilled adult to conduct the intervention. Future research should consider both the ideal outcome of such interventions in terms of quality and quantity of verbal production, and the efficiency and practicability of such techniques.

Studies Completed

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VI. GENERAL DISCUSSION

The findings to this program of research are both straightforward and complex. While data for each subject and for each individual experiment can be summarized succinctly, the whole is greater than the simple sum of the various parts. There are implications for training as well as for future research. In addition to the formal findings of the longitudinal research and individual studies, much was learned about methods for studying language and the attendant difficulties in quantifying a human behavior that has many qualitative aspects.

In this section, three perspectives on the results of the research program are offered: 1) a comprehensive summary of findings in relation to the goals of this project; 2) a discussion of the methodological and analytical problems of language research, and 3) a summary and discussion of recommendations for language intervention.

Research Goals

This program of research had four goals: 1) to describe generalization resulting from individualized language training; 2) to describe the environments of language-learning children in order to determine their effects on generalization; 3) to conduct experimental analyses of training procedures designed to facilitate generalization; and 4) to conduct experimental analyses in natural settings to facilitate generalization. Each of these goals was met in the course of the research program.

Generalization resulting from training

Relatively high levels of generalization for trained nouns and verbs were observed, suggesting that language training is a very effective way to teach new vocabulary. Specific complex syntactic forms (e.g., pronoun-verb-noun, noun-verb-adjective-noun) did not generalize quickly or thoroughly for many subjects, possibly, because complex forms are not necessary to meet the communication needs of most retarded or very young children. Simple syntactic forms (e.g., noun-verb) generalized when multiple exemplars were trained across increasingly complex steps (noun-verb, noun-verb-noun, noun-verb-adjective-noun). When syntactic categories were grouped to represent common semantic relationships (e.g., the semantic class agent-action-object trained by syntactic exemplars: noun-verb-noun, pronoun-verb-noun, pronoun-verb-pronoun, noun-verb-pronoun) and thus, a broader class of forms was considered simultaneously, the evaluation of training was more positive. The number and diversity of exemplars required for generalization of the simplest form varied greatly depending on skills of the student. Profoundly retarded children require many exemplars at even the earliest levels of training.

Examples of syntactic structures that serve an obvious function, such as requesting, generalized quickly to the natural environment. This is not surprising, because the purpose of language is to effect the surrounding environment by retrieving and giving information. Linguistic structure (i.e., syntax) is a code necessary for functional communication and is ultimately controlled by the specific communicative intent of the speaker (Moerk, 1977). Direct reinforcement in the natural environment is contingent on the function of language, not its form. Thus, forms, such as requests, that work to affect the environment are reinforced and generalize easily.

Environments of Language Learning Children

In conjunction with the longitudinal analysis of generalization, observations of the settings in which generalization was expected were conducted. These observations measured the rates of target-subjects' verbalizations, initiations, and responses, as well as the communication demands placed on the subjects by adults and peers in that setting. In general, child verbalizations covaried positively with the amount of demand for language. Settings characterized by frequent requests for language and moderate levels of consequation of language usually were sites for moderate to high levels of generalization. Academic settings and the children's homes were generally the most demanding settings. Across all settings, rates of positive consequation (specific praise) were quite low, suggesting that praise per se is not a vital force in maintaining language performance.

In addition to the description of typical environments of language learning children, several studies were conducted comparing language delayed children with their normal peers. As a rule, language delayed children spoke less frequently than their normal peers and tended to direct most of their utterances to adult, rather than peer, listeners. Adults spoke to language delayed children about as frequently as they spoke to normal children, however, language delayed children were much less likely to respond to adult initiations than normal peers were. Subjects with better language skills received more opportunities to speak than children with minimal skills.

The descriptions of adult and child language behavior in various settings supports a model of language stimulation that is dynamic in nature. Opportunities to interact arise from the child's indication that she/he is capable or willing to participate in social verbal interactions. Competency alone does not determine how much a child speaks or is spoken to. There appears to be a complementary set of social interaction skills that are necessary for verbal interaction to occur. Most retarded children, and many of the language delayed children did not appear to have these performance skills. One critical aspect of future training and research should be the identification and training of supportive interactions skills that will assist the child in recruiting opportunities for language display and engage the child in interactions that offer natural communities of reinforcement for language.

In summary, the most critical element of environments of language learning children is the adult who provides opportunities for language and consequates the child's communication attempts with services or conversation. When adult demand and support is high, children verbalize frequently. Moderately high rates of verbalization appears to support generalization and thus, are probably desirable.

Training procedures designed to facilitate generalization

A number of techniques suggested by Stokes and Baer (1977) were experimentally validated in the course of this project. The findings of these experiments support the Stokes and Baer model for facilitation generalization: use multiple exemplars, multiple trainers, train in several settings, train with indiscriminable contingencies, and train loosely when the initial response has been established. Typically, children with more severe delays in development will require more systematic programming across stimuli, settings, and responses. Extensive use of multiple exemplars was not required for language delayed children but numerous examples were needed to establish generalized resounding in the most severely retarded subjects.

Modifications of environments to facilitate generalization

The most straightforward procedure for facilitating generalization is to increase the demand for language in a specific setting. Several approaches to increasing language demands and support were investigated. Teacher rates of mands (requests for verbalization) models, questions, and reinforcement were systematically increased and resulted in concommittent increases in child language rates and, in some cases, obvicus gains in levels of generalization. Environmental manipulations, such as re-arranging dining hall service and seating, were investigated as means of increasing language opportunities without extensive staff retraining. Modification of adult interaction patterns, although highly effective, is costly in terms of staff time and training. Future research might examine additional environmental rearrangement tactics that support adult interaction with language learning populations without requiring extensive time committments or specific skills.

In the course of attempting to facilitate generalization via increased support and demand for language, it became apparent that some language delayed children may not require extensive individual training on a language curriculum if the environment is modified to support their natural learning attempts. This finding is an important one because although environmentally based interventions are costly, they are much simpler than extended language training. A first step for many moderately delayed children should be systematic increases in their rate of verbalization. Additional structural language training can be initiated if these children fail to show acquisition of new skills at a satisfactory rate in the modified settings.

Although modifications to increase interactions with adults were highly successful, interventions directed toward increasing peer interactions were not. Again, it appears that the skills necessary for social-verbal interaction are separate from linguistic competency. Future research on peer interactions must focus on the differences between adult-child interaction skills.

Methodological Issues

Three types of methodological issues were considered in the course of this research. Two issues, appropriate designs for evaluating generalization and the determination of a criterion to indicate sufficient generalization, were theoretical and scientific concerns. The third issue, procedures for handling the amount of data needed for longitudinal analyses of language is a more practical concern, but nevertheless one that bears on future research in this area. Each of these issues is discussed below because each bears on the overall evaluation and interpretation of the findings reported in the previous section and on the suggestions for clinicians outlined in the subsequent section.

Experimental designs for evaluating generalization in natural environments. In order to empirically demonstrate that the changes in student's language skills exhibited in the natural environment were the result of language training, training was introduced in a multiple baseline design across steps of the training program. Baselines were obtained for all behaviors to be trained and successive steps of the program were trained to criterion as specified by the program. Although this design is ultimately logical and perhaps the only ethical design that could be employed in the context of therapeutic training programs, it does not insure experimental control of the acquisition of language skills.

Changes in the grammatical and semantic structure of the student's language and in the communicative use of language are subtle and it is sometimes difficult to determine which forms and intents the student has generalized from training and which ones were learned in the classroom or at home. For example, if a student used a form such as noun-verb-noun with novel vocabulary in each form slot (e.g., Dog eats bone), it is unclear if the example was the result of the student's training on exemplars o noun-verb-noun structures or incidental learning of such a description in a classroom. Multiple baseline designs across training steps provide formal experimental control; however, the delay between completion of training for a given step and first occurrences of generalized use of the form is often several weeks or months. Thus, although some experimental control can be provided, the latency in emergence of training effects leaves some room for alternative interpretations of the use of more complex forms as evidence of development. With the severely retarded, incidental learning and general development are unlikely in light of their long baselines showing no increases in language use. Many moderately delayed children show

some acquisition, usually minimal, during baseline, and therefore, their data are subject to alternative interpretations. Overall, the therapeutic goals of language training may be met by generalization from training, by increases in the child's development resulting from increased incidental learning, or by a combination of the two. While identifying the source of new language is an important research consideration, it is important only that the student has acquired new skills from a therapeutic point of view. One of the most positive, and as yet undocumented, side effects of intensive one-to-one training might be that the student increases in ability to learn from less structured, naturalistic interactions.

Furthermore, in the strictest sense, the individual steps of a language training program are often not independent from previous steps. Complex grammatical structures are built on simpler ones and thus, acquisition or generalization of the complex forms probably cannot occur until the simpler form has been trained and generalized.

No simple solutions to this methodological problem can be offered. If a less naturalistic assessment of generalization is acceptable, artificial languages or atypical grammatical structures seldom encountered in the natural environment can be trained. Any use of the trained structures under these conditions would necessarily be the result of training, however, the natural environment supplies important stimuli and consequences for language use and these may not be available for artificial linguistic responses. Individual differences make group designs risky, particularly when studying a range of children with varying abilities. Treatment-non-treatment comparisons are likely to show gross differences, but will not allow analysis of the fine points of generalized language usage and may raise serious ethical questions if conducted in a comprehensive treatment facility.

For the time being, the imperfect multiple baseline seems to be the only acceptable alternative. When results are very clear, this design will seem sufficient; when results are ambigous, the design's flaws will be evident.

Determining a criterion for sufficient generalization. Currently, there is no basis for determining how much generalization of a given structure is sufficient to indicate the student's competency with that structure. Because simpler structures decrease in frequency as more complex ones are trained, the criterion must shift to accommodate the student's training history. The demands of the environment play a role as well, however, defining the demands in terms of specific language required by adults or peers proved to be nearly impossible. A competent speaker has numerous options in terms of grammatical structures that may be used to describe an event or respond to a question. In many instances, no one structure is better than any other. Thus, a single question may have many possible answers, all sharing a meaning but expressed by a variety of syntactical structures. A student may use a newly trained structure rarely, yet be a competent communicator. By the same token, the student may use only the newly-trained structure, yet fail to express his intents accurately.

Language is the interface of syntax (structure), semantics, (meaning) and pragmatics (communicative intent). The competent language user manages all three of these components in communicating. In the context of this research program, only syntactic competence was assessed. A complete analysis of generalization from training or development of linguistic competence should consider all three. Alhough this recommendation for future research can be offered, a viable technology for assessing all three components does not currently exist. Until precise measures are developed, quantitative data comparing the social interactions of the language learning child with normal peers in the same setting may be used to evaluate the skills of the child in training. Informal evaluations of teachers and parents may have to suffice until empirical criteria, probably based on additional longitudinal studies of the current type, can be assembled.

Data collection and analysis. The final set of issues are more pragmatic in nature and focus on the mechanics of collecting large numbers of samples of verbatim language data. The data collection and preparation process is very time consuming. A conservative estimate is that each 15 minute transcription required two-three hours of observer time to collect, transcribe and assess the reliability of the transcription. Additional time was required to enter the data into the computer and to analyze and check data returned from the computer. Final calculations and graphing added additional time to the overall total. The use of the computer in performing basic counting and sorting tasks, calculating complexity measures, and tracking generalization and vocabulary development decreased the person-time considerably, but the task was still an ardous one.

The computer programs developed in the course of this project are unique and will hopefully be used by other researchers in this area in the future. Without them, the current analysis would have required five years instead of three. The richness of the data and the availability of computer storage and retrieval will allow further analysis of these data as time and funding permit.

Reliability of transcriptions, training procedures, and rate data was assessed regularly (about once every six observations), however, in retrospect still more stringent reliability procedures are recommended. Because much of the analysis of the data is tedious and susceptible to human error, reliability checks should be made on counting data, entry into the computer, and graphing as well. In any multiple site program of research, reliability should be compared among observers and data clerks in the various sites to insure that the data can be combined across sites validly.

Training observers and data clerks was extremely time consuming but very critical to maintaining consistency during the tenure of the project. Although no attempt to document observer training procedures was made, it is recommended that future research in this area include procedures for efficient training of research assistants.

Summary. In addition to the primary results of the grant, considerable knowledge about the design mechanics of longitudinal language research was gained from this project. Future researchers in this area could contribute to a growing technology for studying language by attending to these issues in their reports of research.

Recommendations for Clinicians

There are many language training programs available and some of these programs are better than others, particularly for certain types of populations. For example, the Guess, Sailor, and Baer (1978) language training program is a function-based curriculum well suited for institutionalized severely and profoundly retarded children. It is extremely well specified within its limited purpose. It does not purport to teach a complete set of normal language skills. Therefore, it would not be wise to use this program with minimally or moderately retarded home-living children. Other programs, such as the Stremel-Waryas program, are better suited to teach more broadly-based skills in a less redundant fashion. Training programs should follow, or be modified to follow these guidelines:

1. Training content should be functional for the student. Training word and sentence forms that the child will never have reason to display in the natural environment is a poor generalization tactic. Emphasize simple sentence forms that are likely to elicit positive consequences for the speaker in terms of actions performed, needs met, or social conversations conducted.

2. Content should be trained using a multiple exemplar format. For example, if the goal is to train a child to make requests, several forms for doing this should be taught. That is, train multiple exemplars of multiple exemplars. For instance, one might train "I want (hat, cup, ball, toy, coke)" and "Please give me (hat, ball, cup, toy, etc.)". Both forms have the same function but have different forms. Incorporate previously trained simpler forms into more complex forms. This ensures repeated exposure to the simple form and allows the student to learn new forms via chaining or shaping.

3. Behavioral procedures should be used throughout training. Almost all programs use some standard behavioral procedures (shaping, modeling, and differential reinforcement). However, these procedures often are poorly specified. Some programs ignore the critical necessity of fading out reinforcement to a schedule more like that found in the natural environment. Instead, reinforcement is delivered after every correct response until the response is acquired. Then, another response or set of skills is trained immediately without fading reinforcement for the first response. Such an approach is likely to result in response extinction (Ferster & Skinner, 1957). Maintenance training using delayed reinforcement is recommended, especially with profoundly retarded children.

Naturalistic reinforcers should be used in training if possible. Food and social praise are often potent reinforcers in training, particularly with severely retarded children. However, these are not the reinforcers available for language in the natural environment. Attention, continued conversation, and fulfillment of requests are more typical consequences. "Natural" reinforcers may have to be introduced gradually and/or paired with primary reinforcers in order to maintain responding, however, unless the student's performance can be maintained with such reinforcers, generalization is unlikely.

4. Other generalization-facilitating formats and procedures can be specified for any language training program. For example, training can be conducted sometimes in a natural environment (e.g., the classroom, the home). Systematic use of two trainers encourages generalization across persons. Training in the presence of peers may be useful for the same reason. Stimuli used in training should resemble ones found in the generalization setting.

In addition to specific training strategies described above, there are several auxilary interventions or modifications that can facilitate generalizations or language acquisition.

1. Teach children to initiate newly-trained language. The training format of many programs only teach the child to respond to questions and models from the trainer. Verbal initiations will help the child recruit reinforcers and language learning opportunities in the natural environment. Excellent suggestions for training children to initiate speech are discussed by Hubbel (1977).

2. Teach skills necessary for participation in conversation: turntaking, following the conversational topic, peer interaction and verbal responsiveness. Unfortunately, little systematic research has been conducted on efficient ways to train these skills. However, normal child data strongly suggest that nonverbal interaction skills and turntaking are important to the development of communicative competence. (Bruner, 1975).

3. Increase the overall rate of the child's language display. Rate is an often overlooked dimension of language delay. Most language deficient children not only speak poorly, but also infrequently. With an appropriate, moderately high rate of speech, a child can contact the natural reinforcers for language as well as provide increased opportunities for trainers or caretakers to expand and discretely correct the child's language by providing alternative models. The use of incidental teaching techniques have been shown quite effective in building rate (Hart, in press; Hart & Risley, 1975).

4. Include parents and caregivers as trainers and facilitators of language in addition to regular direct training by the primary trainer. Their participation in the remediation efforts can facilitate generalization and encourage incidental language tutoring. Most language prompting and training procedures can be easily adapted for parental use. The trainer should see that these are done systematically. Such an approach can effectively make a child's entire environment a language training setting (which is how the environment works for normal children). The use of parent training procedures has been discussed more fully by Schumaker and Sherman (1978), and by Harris (1976).

Measuring generalization from language training in the clinical settings does not have to be prohibitively expensive or unwieldy. It should be a standard part of the overall treatment program. The demonstration that the student has generalized the target responses should be the ultimate criterion for treatment effectiveness. Several generalization assessment strategies can be used by the clinician.

Structured probes should be included as a first step in assessing generalization. If students fail to produce a correct response during the probe it is unlikely they will produce these responses in natural environments when the stimuli and consequent events are even less similar to training conditions. Probes can serve as a useful screening device to indicate which forms require further training for generalization and which forms might be expected to be used spontaneously by the child outside of training. Finally, probes are economic and easy to incorporate directly into the sequence of training. In the flowchart presented below a strategy for the use of probes within the training sequence is presented.

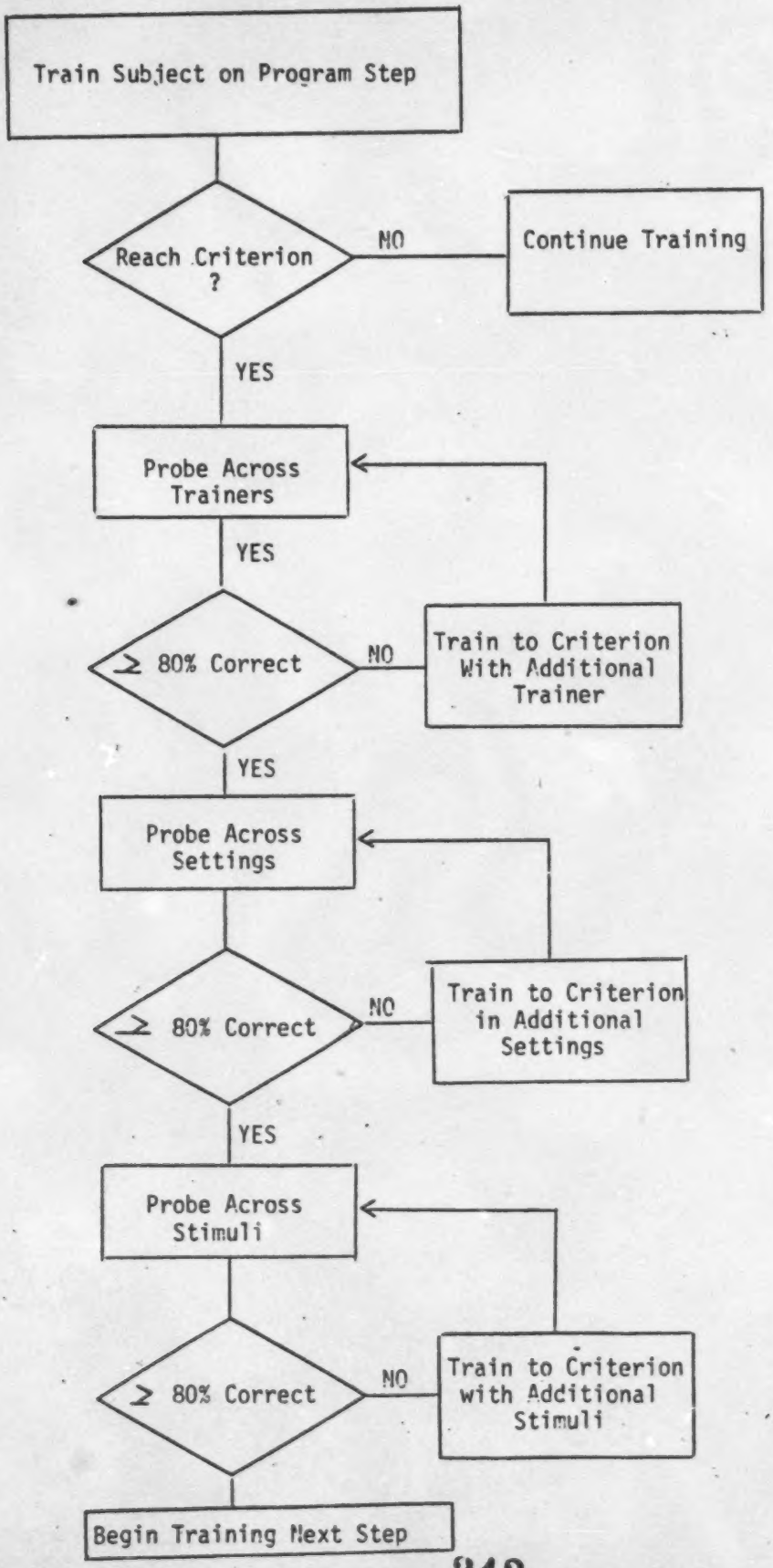
Insert Figure 89 about here

While probes should be a standard part of any training program, they are not reliable indicators of the student's use of the training items in natural environments. Correct responses under probe conditions do not assure students will actually produce these responses in conversational contexts (Warren & Rogers-Warren, Baer & Guess, in press). The cost in both time and effort of generalization measurements in the natural environment does not have to be prohibitive for clinical purposes. A number of approaches may be used, including those outlined below:

1. Teachers and caretakers can be provided with a list of trained forms that have generalized during structured probes. They may then record students' use of these forms during the periods they interact with them. This informal technique may have the added benefit of bringing the caretaker or teacher's attention to the child's progress.

Figure 89

Probe Procedures



2. The parent or teacher might also present probe items from a list of trained forms. These informal probes could be carried out in the context of the student's ongoing activities. For example, if the phrase "want ball" were among the training items, a parent playing ball with the child might hold the ball up and say to the child "What want?". This technique not only provides a measure of generalization, but may be a means of facilitating it.

3. It is also recommended that therapists occasionally make verbatim records of students' speech in nontraining settings. Observations should be made at times when speech is a high probability event for the student. Verbatim observations should be kept as a permanent record of the child's actual language use. Weekly 15-min observations would allow therapists to estimate generalized effects of training on the student's linguistic structure and pragmatic functioning by comparing these samples with the child's training records and past natural samples. Observation times and settings should be varied and the frequency of observations maintained to increase the probability of obtaining reliable, representative samples of the student's language production.

Naturalistic observations may provide therapists with additional information about the dimensions of the student's delay. This information can be used to modify training in ways appropriate to a child's specific disabilities. Naturalistic observations may indicate that a student seldom displays language, even though new forms are learned quite easily in training. This is an indication the child needs training in the pragmatic and social aspects of language, as well as the conceptual aspects.

The naturalistic assessment of generalization by therapists goes hand in hand with other strategies suggested above. In the absence of proven training curricula, this strategy can insure a degree of effectiveness via program modifications made by the trainers themselves.

Conclusion

Overall, the results of this research program were positive. Most children studied acquired some additional language skills apparently resulting from individual language training. In the course of the grant, descriptions of naturally occuring generalization and the environments of language learning children were acquired. Studies demonstrating the viability of environmental and training-based interventions were conducted. Although many methodological issues remain unresolved, significant progress in both the theoretical and practical aspects of studying language was made. This program of research has numerous implications for language training and the findings report herein should be of interest to clinicians.

Language is one of the most critical human skills. When a child fails to fully learn a communicative repertoire in the natural course of development, every reasonable effort should be made to treat this deficit. The development of comprehensive language training programs during the past 15 years has greatly improved the treatment of language deficits. However, current programs represent only the initial step toward an effective comprehensive technology of language remediation. Further improvement of language intervention efforts will require incorporation of recent developmental research findings, further development of a technology of generalization, and continued longitudinal measurements of generalization in the natural environment to evaluate new programs' effectiveness. In the meantime, educators and clinicians are urged to adopt and modify programs with the intent of enhancing generalization of trained skills and to insure the effectiveness of these modifications through systematic generalization assessments. Future major improvements in the field of language remediation may depend on the pursuit of these recommendations.

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